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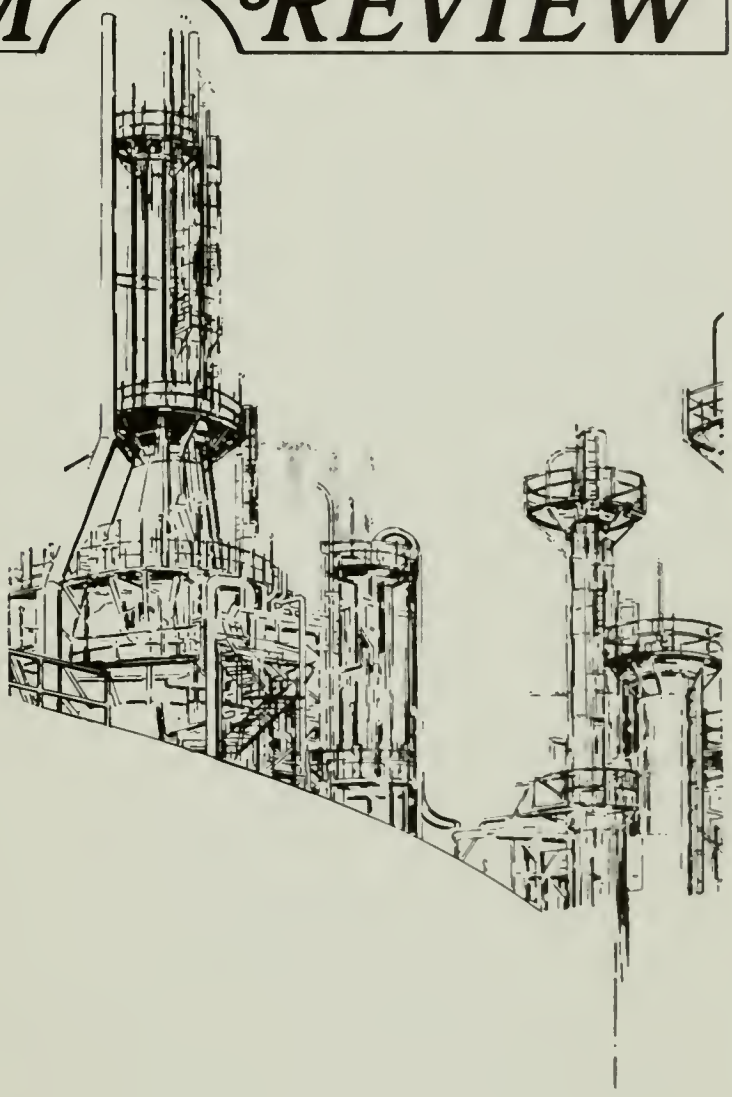

Prepared by
Natalie Walsh

Energy Division

MONTANA DEPARTMENT OF NATURAL
RESOURCES AND CONSERVATION

32 South Ewing
Helena, Montana

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INTRODUCTION

The vulnerability of petroleum fuel supplies to disruption was apparent in the events of the past year, particularly when gasoline lines developed across the country in the spring of 1979. Reliable information regarding the extent and consequences of the fuel shortage was almost completely lacking, and incomplete and often conflicting reports from the petroleum industry and the federal government contributed to public suspicion that the oil companies were manipulating fuel supplies and that the shortage was contrived.

When a shortage of diesel fuel occurred in Montana in May and June of 1979, farmers trying to plant their fields, and truckers struggling to keep their rigs moving, turned to the state for information and responsive action. In the absence of reliable data compiled by the state, administrators were forced to depend on unreliable information from federal sources. (The U.S. Department of Energy data indicated that 1979 diesel fuel supplies in Montana were adequate, because several companies had simply not reported their 1978 deliveries in Montana.) The Energy Division established a fuel supply survey by early June, but hard data were not available for assessing the geographical distribution and extent of the shortage or for determining where supplies of fuel, if any, were stored in the state.

Fortunately, the diesel fuel shortage, though serious, did not become critical. State administrators were able to mitigate most of the effects of the shortage in spite of the lack of reliable information. But the shortage clearly demonstrated the need for an independent fuel supply-demand monitoring system at the state level to provide a basis for informed decision-making.

The following review of Montana's fuel production and supply system shows how the petroleum industry normally operates in Montana and the ways in which shortages are likely to occur. Montana refinery production, and petroleum product distribution and marketing, are reviewed, and recent trends in refinery production and storage of crude oil and finished fuel are compared with supply and consumption data for the state.

Fuel Allocation in Montana

Even in the absence of a national or international disruption, Montana is ordinarily vulnerable to fuel supply shortages because of its small, geographically dispersed population.

To begin with, several oil companies are in the process of ceasing to supply petroleum products to Montana customers. These withdrawals started several years ago, when finished fuel supplies were ample, as a result of efforts within the petroleum industry to consolidate marketing areas.

For the most part, the companies remaining in Montana have expanded their shares of the market to take up the slack left by the withdrawals. When surplus fuel supplies are not available to meet this extra demand, however, most companies do not supply new customers, since their supply obligations are usually based on the volume of fuel their customers purchased in the past. In other words, though some companies contract each year for specific volumes, most use a base-period system to allocate fuel. A base-period system means that the volume of fuel the customer purchased from the oil company in the corresponding month of a specified (or chosen) base year is designated as the base-period volume for that month.

When an oil company's fuel supply is greater than its base-period obligations, it can sell the surplus fuel on the spot market, make extra fuel available to its base-period customers, and/or

expand the company's marketing areas by supplying new customers.

When the fuel supply is less than an oil company's base-period obligations, the company can distribute the short supply equitably by allocating to each customer a percentage of the base-period volume. This percentage is called an allocation fraction.

The federal fuel-allocation regulations, which now apply only to gasoline and propane, require an oil company to use a base-period for allocating fuel. The regulations specify that the base-period will be November, 1977 through October, 1978. If, in any month, a company has insufficient fuel to meet its base-period supply obligations, it must impose a nationwide allocation fraction to spread the burden of the shortage equally among all of its customers. A national system of allocation is normally used for the unregulated products, distillate fuel and aviation gasoline, as well.

Thus, a wholesale distributor's supply of fuel depends primarily on the nationwide supply situation of the company from which the distributor purchased fuel during the base-period. Distributors who obtain fuel through contract with an oil company are also vulnerable to shortages, because an expiring contract is subject to renegotiation and may not be renewed.

Although problems arise from the rigidity of the federal regulations, and it may take DOE many months to process requests and assign fuel supplies, the controls at least guarantee Montanans an equitable share of gasoline. The companies withdrawing from Montana are required to arrange for their customers to be supplied by another company, for example, and the Department of Energy (DOE) has established mechanisms for transferring gasoline from a closed bulk plant to open plants in the area. Furthermore, new customers can obtain suppliers, and established customers can obtain increased allocation, by means provided through the allocation controls.

Distillate fuel oil and aviation gasoline, on the other hand, are not controlled. As a result companies are not required to continue to supply old customers or to meet new or increased fuel needs. If a bulk plant closes, the area may lose some or all of its allocation of diesel fuel and heating oil. And though most companies do try to fulfill their established customers' fuel requirements, they are not legally required to do so. When fuel is in short supply, low-volume sales dispersed over a large area like Montana are much less profitable than sales to the highest bidder on the spot market.

In a national or international disruption of crude oil supplies, each company is affected differently according to its ability to retain access to supplies of crude oil. For example, most of the major oil companies have established fairly stable sources of crude oil. Unless its particular sources are directly affected, a company is not likely to be as affected by a national or international disruption as a smaller, less powerful company competing for scarce crude oil on the spot market would be. Fuel shortages in some Montana communities will therefore be far more severe than in others, depending on the supply situation of the companies marketing in that community. A related factor increasing the likelihood of shortages is that many areas of Montana depend on just one or two jobbers (distributors) or oil companies for their fuel supplies.

Because large areas are covered by a few distributors, minor supply disruptions, or sudden increases in fuel demand, can create logistical problems. For example, a severe cold spell might increase demand for heating oil at a time when the jobber's fuel inventories are low. Jobbers in the same area often cooperate to relieve spot shortages through fuel trades or sales. If there are only a few jobbers in an area, however, the distribution system is less flexible.

Data Sources

Although virtually all petroleum data ultimately come from the oil companies themselves, they are compiled in a variety of federal, state, and industry reports. Data compiled by different agencies are often inconsistent due to differences between agencies in reporting requirements, company nonreporting, and agency tabulation errors.

Information regarding inventories of crude oil in Montana and monthly refinery throughput is compiled by the Montana-Oil and Gas Commission and by the Energy Information Administration (EIA) of the U.S. Department of Energy (DOE). The Oil and Gas Commission tracks the

exploration and development of the state's crude oil and natural gas resources and requires refiners to report monthly receipts and disposition of crude oil. The DOE monitors crude oil inventories by requiring pipeline companies, refiners, producers and terminal operators to report end-of-month stocks by state and storage location — refinery, pipeline, terminal, or producer lease — on the Crude Oil Stocks report (EIA 90). Refiners are also required to submit detailed monthly production and inventory data, by type of crude oil feedstock and finished fuel, in the Refinery Report (EIA 87).

The Montana Oil and Gas Commission publishes a monthly statistical bulletin and an annual report in which crude oil inventory and refinery throughput is detailed for each refiner. The DOE issues several monthly and annual Energy Data Reports containing state or regional information derived from the EIA 87 and EIA 90 data. Furthermore, at the request of the DNRC Energy Division, the DOE extracts Montana data from the federal data base and provides tabulations of aggregated company data, four to six weeks after the EIA 87 and EIA 90 reports are filed with DOE.

State and federal sources of crude oil and refinery processing information are both cited in the following report, but the data are not directly comparable. Whereas the DOE tabulations provide separate data on natural gas liquids and crude oil, the Montana Oil and Gas Statistical Bulletin does not distinguish between these two types of refinery feedstock. Combining data for natural gas liquids and crude oil reduces the disparity between the two data sources, but slight discrepancies remain unresolved.

Petroleum fuel inventories are reported to DOE as total end-of-month stocks held in each state. Refinery inventory data are included in the Refinery Report (EIA 87). Stocks held in inventory at pipeline terminals and at facilities with storage capacity of at least 50,000 barrels are reported on the Bulk Terminal Stocks Report (EIA 88). The DOE provides tabulations of Montana fuel inventory data to the DNRC Energy Division on a regular basis.

Companies that make the first sale of fuel into the state's distribution system are required to file a monthly Prime Supplier Report (EIA 25) with the DOE Energy Information Administration and with the DNRC Energy Division. The EIA 25 report is submitted by the first of the month and reports the volume of fuel delivered the previous month as well as the anticipated supply for the present month. From these reports, which have been filed since 1974, the Energy Information Administration compiles monthly tabulations comparing the month with previous years' data. These reports became suspect, however, when diesel fuel shortages developed in Montana in 1979 even though the DOE data indicated that diesel fuel deliveries had **increased** over previous years' levels.

Comparing the original EIA 25 reports, filed with the Energy Division, with the DOE's tabulated reports revealed substantial errors in the DOE data base. The two major problems are differences between companies reporting data on the same fuel, particularly distillate fuel oils, and non-reporting of certain fuels, or even all fuels, by some companies.

The EIA 25 reporting form itself contributes to the inconsistencies between companies in reporting distillates. The form provides for four categories of distillate fuel: kerosene, #2 heating oil, #2 diesel fuel, and other mid-distillates. Although the American Society for Testing and Materials (ASTM) specifications for kerosene and #1 distillate are different, most companies use the kerosene category to report deliveries of #1 distillate. Some companies, however, group #1 distillate with either #2 heating oil or #2 diesel fuel, and prior to 1978 a few companies even reported this fuel in the mid-distillate category with an identifying label. Accurate data for #1 distillate is especially important in Montana because this lighter fuel is used as a cold weather blend to raise the pour-point of #2 distillate fuel.

The two categories of #2 distillate on the EIA 25 form also contribute to inaccuracies in DOE's data base. ASTM specifications for heating oil and diesel fuel are slightly different, but most companies raise the cetane rating of heating oil so that it can be burned in diesel engines. Therefore, for most companies the #2 fuels are the same product. Some companies do attempt to distinguish between heating oil and diesel fuel on the EIA 25 form, but others just list the volume of #2 distillate in one category or the other.

Another problem is that companies have sometimes reported fuel deliveries on the EIA 25 form to the DNRC Energy Division but apparently not at the federal level, as these deliveries are not included in the DOE's fuel reports to Montana. The reverse situation, companies reporting at the federal level but not at the state, has also occurred.

Futhermore, the EIA 25 reports that are filed are not necessarily complete. When the distillates were removed from the state set-aside fuel program in April, 1978 (until January, 1979), several Montana suppliers stopped reporting this fuel on the EIA 25 form. Therefore, the DOE tabulations indicated that these companies delivered no diesel fuel or heating oil for several months, though the same companies have reported in telephone spot checks that they supplied large volumes of fuel to Montana during the months in question in 1978.

Recognizing the inaccuracies in the DOE data base, the Energy Division now compiles the EIA 25 reports manually and combines the four types of distillate fuel oil in one category. Until a complete state data base is established, however, DOE tabulations will continue to be a supplementary source of information.

In theory, fuel consumption should be indicated by supplies plus or minus changes in inventory. In practice, however, inventory data are available only for facilities with at least 50,000 barrels (2.1 million gallons) of storage capacity. Consequently, it is not possible to determine fuel use by this method. Consumption can be established, however, for the fuels subject to a tax — motor gasoline, aviation gasoline, and diesel fuel for highway use. Since diesel fuel for off-road use, heating oil, and kerosene are not taxed, consumption data on distillate fuel oil are incomplete and cannot be established from existing data sources.

The Montana Department of Revenue, Motor Fuels Tax Division, receives monthly reports from licensed distributors on the volume of motor gasoline and aviation gasoline sold. The licensed distributors include all of the prime suppliers, reporting to the DOE on the EIA 25, plus a few of the state's largest jobbers and brokers. The Motor Fuels Tax Division computes the total taxable gallonage of each distributor and publishes the company-aggregated total for the state. Therefore, though these tax data may be a fairly reliable measure of the state consumption, they do not show how these fuels are distributed within the state.

Information about the geographical distribution of company marketing areas within the state is available from the Montana Petroleum Association, an industry organization that publishes a monthly "Montana Gasoline Gallonage Report." Compiled from company sales records, this report indicates the volume of gasoline sold in each Montana community.

Surveys conducted by the Office of Energy Data and Interpretation regarding sales of distillate fuel oil may be a supplementary source of information on consumption of this fuel in Montana. This office publishes monthly and annual Energy Data Reports, showing Montana sales by industrial, utility, heating, military, railroad, highway, and other fuel-use categories. Because the Montana sample is extremely small, however, these data are not statistically reliable.

REFINERY PRODUCTION

Processing Capability and Crude Oil Feedstock

Montana's refineries range from the independent Kenco refinery at Wolf Point, capable of processing only 4,750 barrels of crude oil each day, to the Exxon and Conoco refineries in Billings, which can process 47,000 and 54,500 barrels of crude oil, respectively, each day. Phillips Petroleum Company operates a relatively small refinery — 6,500 barrels per day — outside Great Falls, and the Westco refinery at Cut Bank processes a maximum of 6,000 barrels of crude each day. The Cenex (Farmers Union Central Exchange) refinery at Laurel, with a rated capacity of 42,500 barrels per day, is comparable in size to the Billings refineries. Refinery processing capability and source of crude oil feedstock are summarized in table 1.

Petroleum refineries are generally not maintained at maximum production throughout the year, due to seasonal changes in demand, variation in supply, and the down time required for safety inspections and maintenance. Monthly variations in the total volume of crude oil processed, and the contribution of Canadian crude oil to this total, are illustrated in figure 1 for the years 1976 through 1979.

Although seasonal trends are not entirely consistent throughout this four-year period, the data indicate that Montana refineries operate at their highest levels during the summer months. Production is lowest in the late winter and early summer, declining to its lowest level in April.

Annual fluctuations in the total volume of crude oil processed correspond approximately to annual increases and decreases in the volume of Canadian crude oil refined in the state. This relationship is especially apparent in 1978.

Monthly variations also occur in the stocks of crude oil held in inventory at Montana refineries, pipelines, tank farms, and producer leases, as well as in the level of refinery stock alone (see figure 2). Although the volume of crude oil held in inventory at the refineries seems to vary with total statewide inventories, there are no consistent seasonal trends in these inventories. Furthermore, no clear relationship exists between crude oil stock and refinery production.

TABLE 1
REFINERY CAPACITY AND SOURCE OF CRUDE OIL, 1978

	PROCESSING CAPABILITY[1] (barrels/day)		PERCENTAGE OF CRUDE OIL FROM EACH SOURCE, 1978[2]			
Refinery	Crude	Condensate	Montana	Wyoming	N. Dakota	Canada
Conoco	38,000	16,500	19.2	22.1	---	58.7
Exxon	47,000	---	3.6	65.7	---	30.7
Cenex	42,500	---	7.8	35.7	0.5	56.0
Phillips	6,500	---	74.2	---	---	25.8
Westco	6,000	---	100.0	---	---	---
Kenco	4,750	---	99.5	---	0.5	---

[1]Individual refineries verified this information, since it was not consistent in DOE and industry publications.
[2]Montana Department of Natural Resources and Conservation, 1978.

Petroleum Products

The quantity of each type of petroleum product derived from a barrel of crude oil is different for each of Montana's refineries because it depends on the processing capability of the refinery. For example, the small Kenco refinery, unable to produce gasoline, emphasizes production of the heavier distillate and residual fuels. The Exxon refinery, on the other hand, is the only Montana refinery with the special equipment required to manufacture aviation gasoline.

The larger refineries in the state are flexible with respect to the relative volumes of gasoline and distillate fuel oil produced. For example, a relatively complex refinery processing light crude oil and maximizing gasoline production can reduce gasoline output by about 5 percent in order to increase its distillate production by 10 to 15 percent (Bonner and Moore Associates 1976).

The proportionate volume of each fuel produced also depends, however, on the quality of crude oil that the refinery processes. More of the lighter products such as gasoline and distillate can be extracted from light crude oils, such as Canadian crude oil, than from heavier crude oils such as those from Wyoming.

The annual volume of crude oil and natural gas liquids processed by Montana refineries, and the corresponding volume of finished fuel output, is depicted in figure 3 for the years 1976 through 1979.

In 1978, Montana refineries collectively processed a total of 48,853,000 barrels of crude oil and natural gas liquids, using an average of 83 percent of the total maximum refinery capacity for the year. In 1979, despite the national shortage of crude oil, Montana refineries processed 51,675,000 barrels of crude oil and natural gas liquids (table 2), an increase of 5.8 percent in refinery input, and operated at an average of 88 percent of refinery capacity for the year. This increased use of refinery capacity in 1979 was primarily due to a 25.7 percent increase in crude oil exchanges with Canada over 1978 levels. Supplies of crude oil from Montana, Wyoming, and North Dakota, up by 2.9 percent over 1978, also contributed to the increased input, which came to 5.4 million barrels, or a 12.2 percent increase from 1978 to 1979. Refinery processing of natural gas liquids, however, declined by almost 60 percent, or 2.6 million barrels from 1978 to 1979, apparently because Canada reduced its supply of crude oil condensate.

The relative proportions of the different types of fuel produced in 1978 and 1979 are shown in table 3. Although slight shifts in refinery emphasis can be detected, there is relatively little change in the mix of fuels produced during this period. The total volume of most finished fuels produced in 1979 by Montana refineries, however, was greater than in 1978, due to the increased volume of crude oil processed in 1979. Data on refinery production relative to Montana fuel supply for 1978 and 1979 are summarized in table 4.

TABLE 2
REFINERY INPUT BY FUEL TYPES PROCESSED 1978-79

	1978		1979	
	Volume (1000 Barrels)	Percentage	Volume (1000 Barrels)	Percentage
Natural Gas Liquids	4,364	8.9	1,760	3.4
Crude Oil				
Domestic	26,382	54.0	27,149	52.5
Canadian	18,107	37.1	22,766	44.1
TOTAL	48,853	100.0	51,675	100.00

TABLE 3
REFINERY OUTPUT BY FUEL TYPE PRODUCED, 1978-79

	1978		1979	
	Volume (1000 Barrels)	Percentage	Volume (1000 Barrels)	Percentage
Propane	532	1.1	521	1.0
Motor Gasoline	26,846	54.0	27,717	51.7
Aviation Gasoline	83	.2	99	.2
Jet Fuel	2,585	5.2	3,210	6.0
Distillate Fuel Oil	11,808	23.7	12,828	23.9
Residual Fuel Oil	1,848	3.7	1,919	3.6
Coke, Asphalt, Road Oil	4,516	9.1	4,685	8.7
Other Products	57	.1	205	.5
PetroChemical Feedstock	59	.1	427	.8
Refinery Fuel	1,411	2.8	1,958	3.7
TOTAL	49,745	100.0	53,569	100.1

Refinery Production Relative to Montana Supply

Table 4 reveals that Montana is a net exporter of motor gasoline, jet fuel, distillate, and residual fuel oil, and a net importer of aviation gasoline.

The data in table 4 also show that the fuel available to Montana consumers is not necessarily related to the level of fuel production at Montana refineries. For example, refinery production of motor gasoline increased 3.2 percent in 1979, but delivery of this fuel in Montana declined by 3.3 percent. This means that while refineries increased their out-of-state export of motor gasoline by more than 54 million gallons (one barrel equals 42 gallons) in 1979, the oil companies marketing gasoline in the state decreased deliveries to Montana by more than 17 million gallons from the previous year's supply.

Monthly fluctuation in the volume of Montana refinery product output, due in 1979 to the disruption of the internal petroleum market, is not apparent in the annual data compiled in table 4. Comparative analysis of data on monthly production of gasoline, distillate fuel oil and aviation gasoline, levels of stocks held in inventory, and the volume supplied to Montana consumers is presented below under the heading FUEL DATA TRENDS.

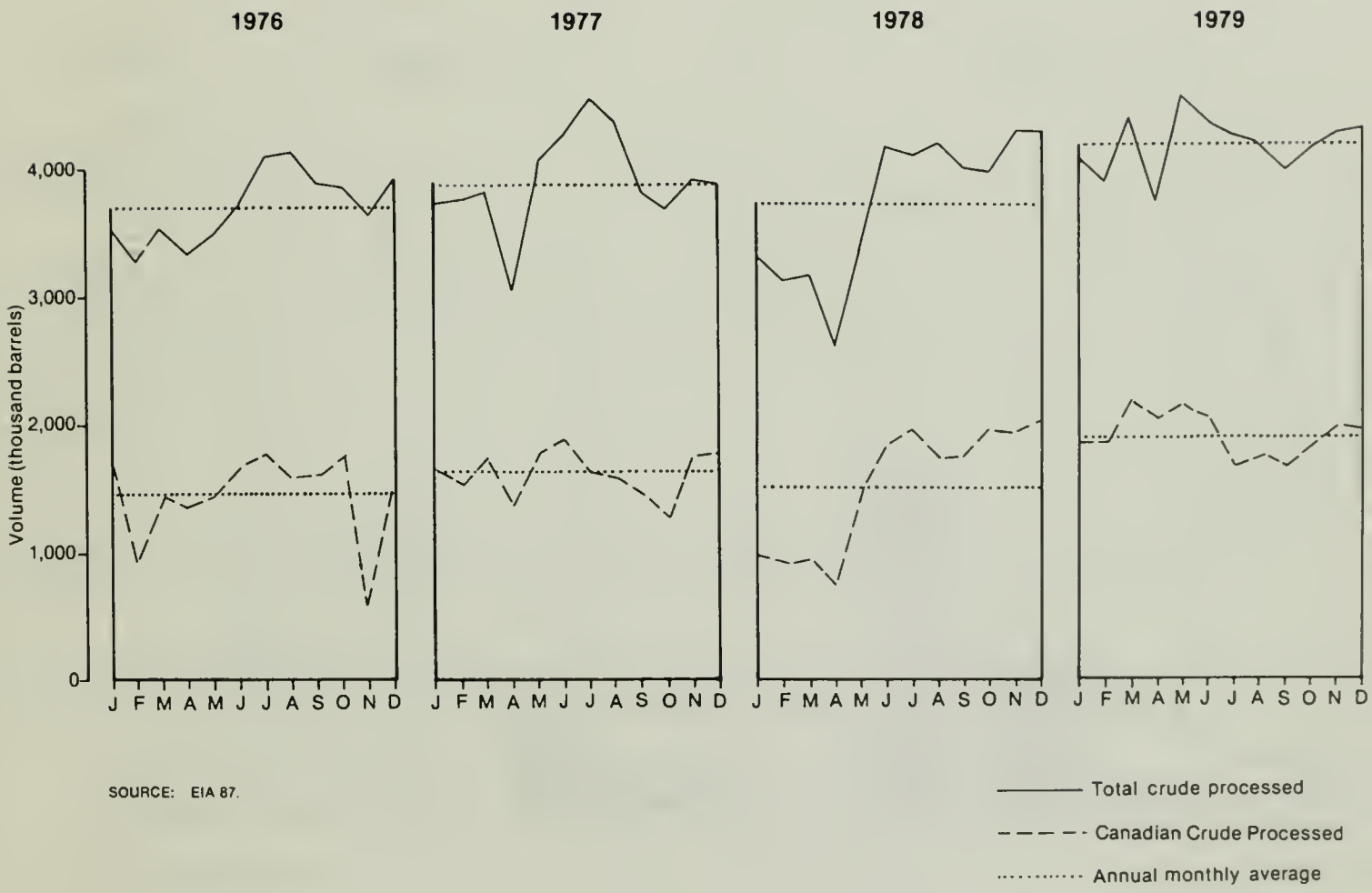
TABLE 4
REFINERY PRODUCTION COMPARED WITH FUEL SUPPLY, 1978-79

Product	REFINERY PRODUCTION[1] Barrels 1978	1979	Percentage Increase or Decrease	MONTANA SUPPLY[2] Barrels 1978	1979	Percentage Increase or Decrease
Motor Gasoline	26,846,000	27,717,000	3.2	12,817,395	12,390,923	- 3.3
Aviation Gasoline	83,000	99,000	19.3	137,100	113,400	-17.3
Jet Fuel	2,585,000	3,210,000	24.2	940,100	755,524	-19.6
Distillate Fuel Oil	11,808,000	12,828,000	8.6	6,997,346	7,180,278	2.6
#1 and #2 Distillate				6,690,746	6,682,773	- 0.1
Other Middle Distillate				306,600	497,505	62.3
Residual Fuel Oil	1,848,000	1,919,000	3.8	1,297,800	1,183,753	- 8.8

Product	NET ⟨IMPORT⟩ OR EXPORT[3] Barrels 1978	1979	Percentage Increase or Decrease	PERCENTAGE ⟨IMPORT⟩ OF TOTAL SUPPLY OR PERCENTAGE EXPORT OF TOTAL PRODUCTION 1978	1979
Motor Gasoline	14,028,605	15,326,077	9.2	52.3	55.3
Aviation Gasoline	⟨54,100⟩	⟨14,400⟩	-73.4	⟨39.5⟩	⟨12.7⟩
Jet Fuel	1,644,900	2,454,476	49.2	63.6	76.5
Distillate Fuel Oil	4,810,654	5,647,722	17.4	40.7	51.6
Residual Fuel Oil	550,200	735,247	33.6	29.8	38.3

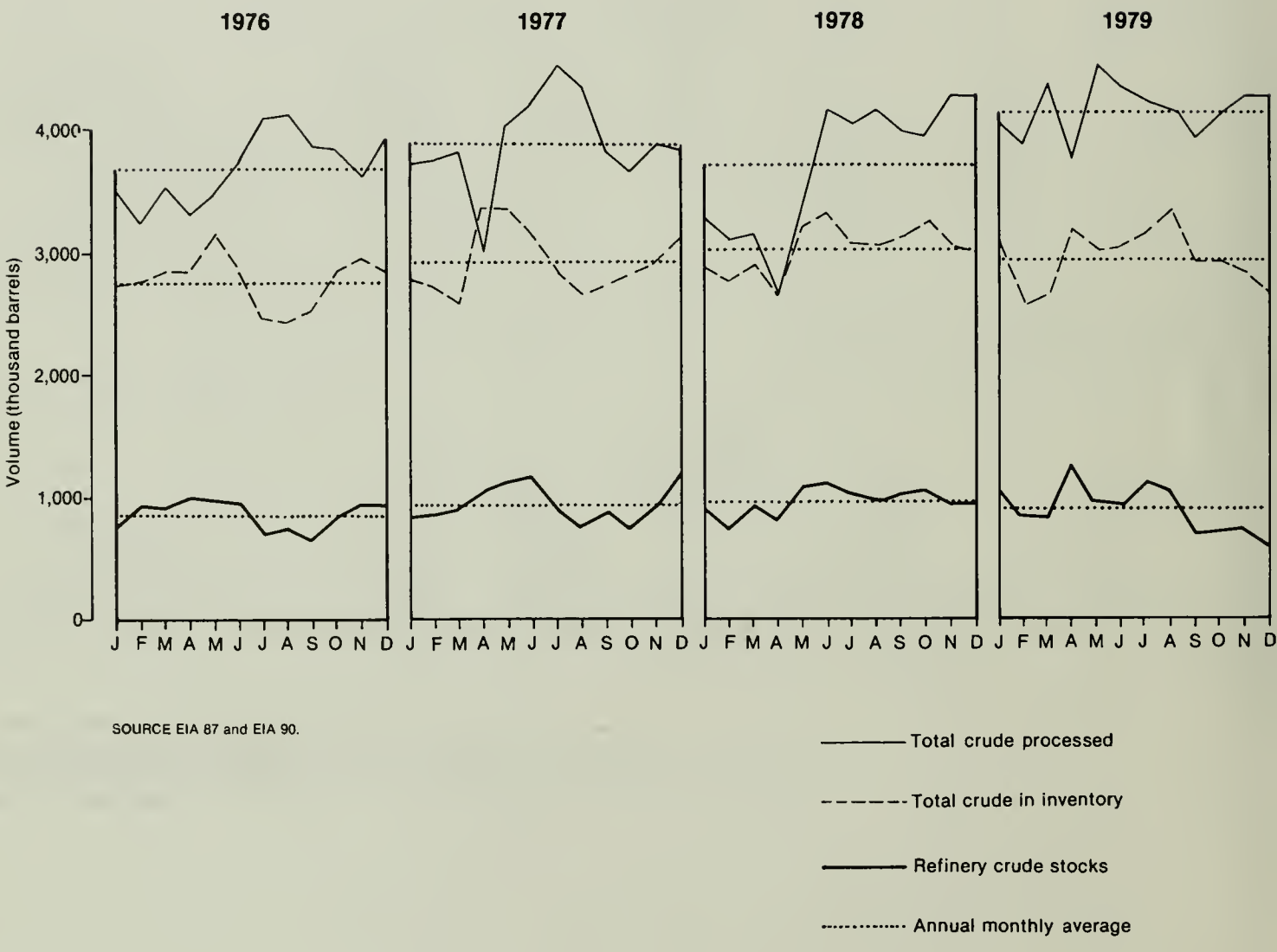
[1]EIA 87, Refinery Report, data aggregated by DOE.
[2]EIA 25, Prime Supplier Report, data compiled by Energy Division and DOE.
[3]Data derived by Energy Division from refinery production and prime supplier delivery data.

Figure 1 Crude oil processed by Montana refineries, 1976-79



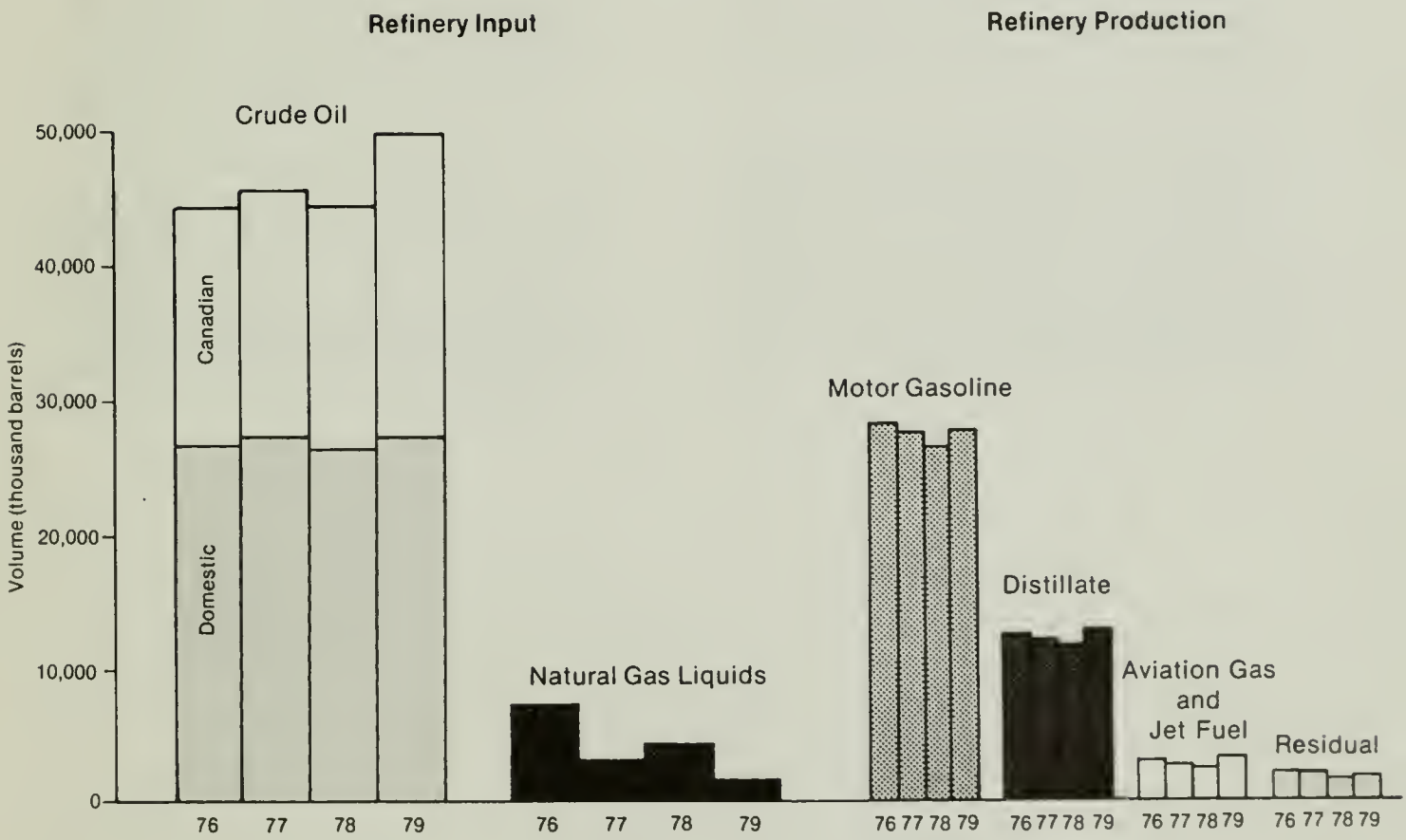
SOURCE: EIA 87.

Figure 2 Crude oil processed and stocks held in inventory, 1976-79


1976
1977
1978
1979
Volume (thousand barrels)
4,000
3,000
2,000
1,000
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
Total crude processed
Total crude in inventory
Refinery crude stocks
Annual monthly average

SOURCE EIA 87 and EIA 90.

Figure 3 Crude oil processed and type of fuel produced, 1976-79



SOURCE: EIA 87.

PRODUCT DISTRIBUTION

Pipelines move gasoline and distillate fuel oil from one population center to another, and tanker trucks transport it from the pipeline bulk terminals to its destination. The heavier residual fuel is usually carried directly from the refinery by truck or railroad tanker to its destination.

Billings is the main distribution center for petroleum products in Montana, since the three refineries in the Billings area jointly process about 90 percent of the crude oil refined in the state. Furthermore, the Shoshone pipeline, which brings fuel from the Husky refinery in Cody, Wyoming, to Billings, is the only pipeline carrying finished fuel into Montana.

Three major product pipelines carry fuel west, east, and south from Billings:

1) Yellowstone (Continental) pipeline, with bulk terminals in Bozeman, Helena, and Missoula, and a branch line from Helena to Great Falls, carries fuel to the major cities of western Montana. From Missoula the Yellowstone pipeline continues west to Spokane and Moses Lake, Washington.
2) Cenex pipeline, with a bulk terminal at Glendive, carries fuel east to Minot, North Dakota.
3) Seminoe (Continental) pipeline delivers fuel to bulk terminals in Wyoming and connects to pipelines serving Denver and Salt Lake City.

PRODUCT MARKETING

Although six oil companies produce most of the petroleum fuels consumed in Montana, twenty-three oil companies market fuel in the state. Most of these marketing companies do not bring their own fuel directly into Montana for resale. Instead, the oil companies have worked out a system of exchange agreements to save transportation costs.

Montana fuel imports and refinery production can be considered a pool from which the marketing companies draw their supplies. Because petroleum products are exchanged between companies at the refinery and throughout the distribution system, the additives that distinguish one company's product from another's are not added until the fuel reaches the wholesale or retail market.

Companies market their fuel to three customer classes: wholesale distributors or jobbers; retail stations and truck stops; and large commercial or industrial accounts.

Jobbers supply fuel to bulk fuel customers, to retail stations and truck stops that do not purchase fuel directly from a oil company, and to other jobbers. Customers who buy in bulk from a jobber include agricultural, commercial, and industrial accounts, government agencies, and residential heating oil accounts. Retail stations and truck stops pump fuel directly into the tanks of their customers' vehicles. The large fuel-consuming industries, such as railroads and mining companies, purchase fuel directly from an oil company, eliminating the jobber.

FUEL DATA TRENDS

Motor Gasoline

Since 1972 Montana refineries have consistently produced between 27 and 28 million barrels of gasoline a year (EIA 87). Motor gasoline production, depicted in figure 4 and 5, fluctuates seasonally, peaking in late spring and again in early winter. This seasonal variation is relatively slight and averages less than 3 percent of annual production.

Although refinery production of motor gasoline increased by 3.2 percent in 1979, the monthly trends depicted in figure 5 show that production fell in 1979 during the period from June through October. Gasoline production reached the lowest level in four years in July, August and October 1979, but the volume produced in these months was still within the range of normal seasonal fluctuation in gasoline production levels.

Stocks of motor gasoline held in inventory at Montana refineries and major bulk terminals are gradually built up through the fall and winter for the spring and summer driving season (EIA 87 and 88). In the annual October-September cycle, shown in figure 6, inventory levels that peak in March are drawn down to minimum levels by early fall.

A review of this annual cycle over the past seven years reveals no consistent trend in the overall average inventory maintained during an annual cycle. Gasoline stocks fell 21.6 percent in 1978-1979 from the high levels maintained in 1976-1977, as shown in figure 7, but a similarly low volume was retained in inventory in 1975-1976.

Monthly gasoline supplies to Montana are compared with Montana refinery production and stocks held in inventory in figure 8. This graph shows that gasoline supplies exhibit a strong pattern of seasonal growth and decline, corresponding to changes in weather and travel-related fuel demand. Gasoline consumption falls to a minimum level in late winter, climbs steadily through the spring, peaks in August, then gradually decreases in the fall and winter. (Not only do Montanans travel more in-state as the weather improves, but the number of out-of-state travelers increases in the summer as well (Montana Automobile Association 1980).)

According to the prime-supplier fuel delivery data (EIA 25) the oil companies marketing motor gasoline in the state supplied approximately 3.3 percent less gasoline to Montana in 1979 than in 1978. The monthly variations in supply, illustrated in figure 9, reveal that the 1978-79 decline was largest in the period from June through September. In the first five months of 1979, deliveries of motor gasoline rose almost 5 percent over the volume supplied in 1978, but then supplies fell sharply below the previous year's levels — by 10.6 percent — during the summer months. Gasoline supplies stayed below 1978 levels from October through December, but by less than 3 percent.

State gasoline tax records indicate that gasoline consumption in Montana has grown 26.9 percent since 1970 (Montana Department of Revenue, Motor Fuels Tax Division). Although this might suggest an average annual rate of growth of 3 percent, actual annual fluctuations, illustrated in figure 10, indicate a fairly complex pattern of consumption increase and decrease over the past decade.

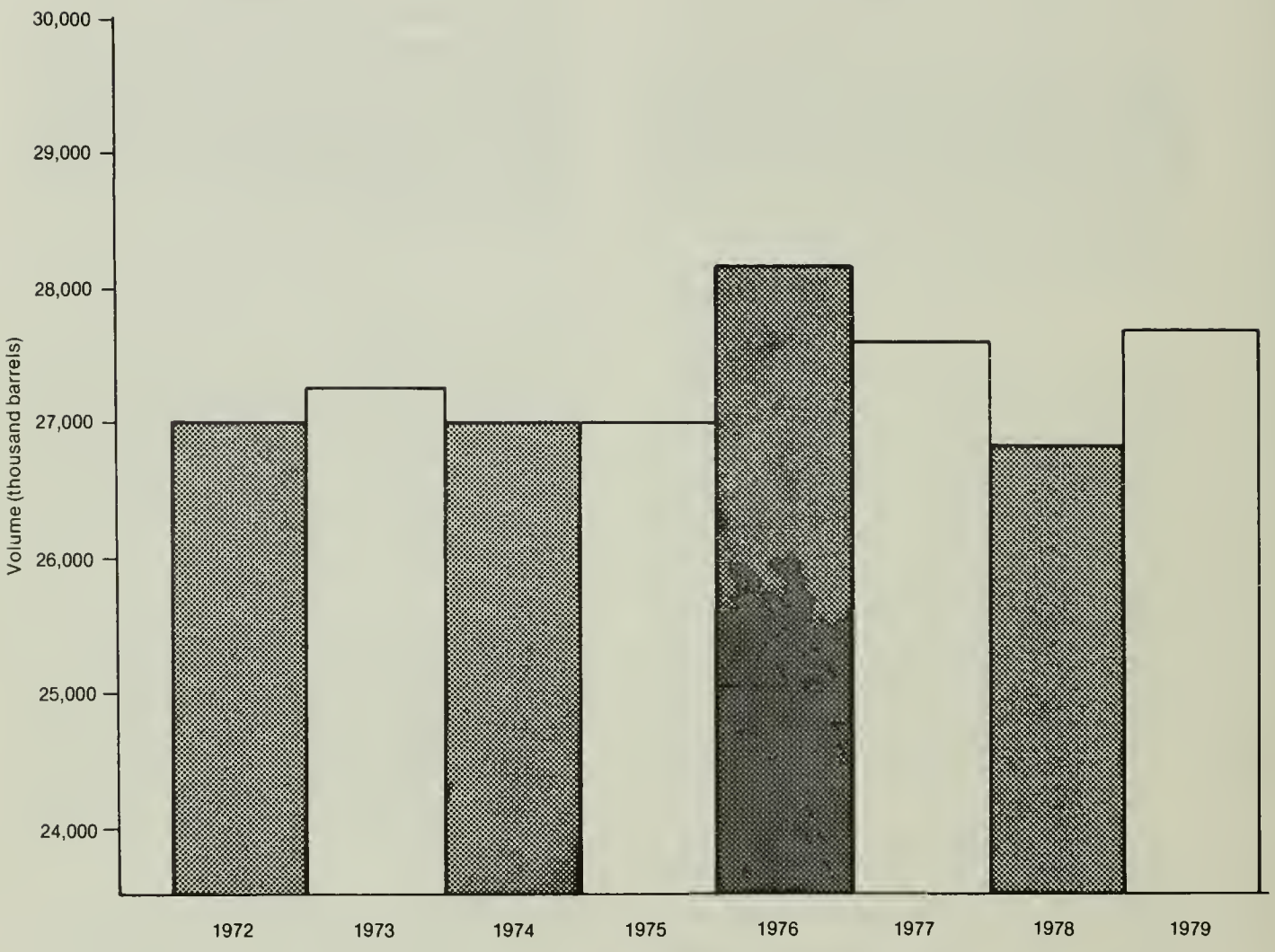
In the early 1970's gasoline use grew at the rate of 5 to 6.5 percent annually. After the Arab oil embargo and accompanying escalation in fuel price, however, gasoline consumption fell by 3.4 percent in 1974. This decline was relatively shortlived, as the previous pattern of con-

sumption growth resumed in 1975 and reached a 6.5 percent annual rate of increase in 1976. Gasoline consumption continued to expand in 1977 and 1978, but at a slower rate — less than 4 percent annually — and in 1979 consumption decreased sharply, by 6.1 percent, following the disruption of the international petroleum market.

The Montana Petroleum Association's Monthly Gasoline Gallonage Report, compiled directly from prime-supplier marketing data, is the only source of community-level data on gasoline sales. (For reasons not yet known, Montana Petroleum Association sales figures have been slightly lower than the taxable gallonage reported by the Montana Department of Revenue, since 1973 (figure 11).) According to this report, counties vary widely in the volume of gasoline sold in 1979, compared with 1978. Gasoline sales increased in nineteen counties but declined in thirty-seven, this past year, and fourteen counties experienced more than 10 percent reduction in sales (see table 5 and figure 12).

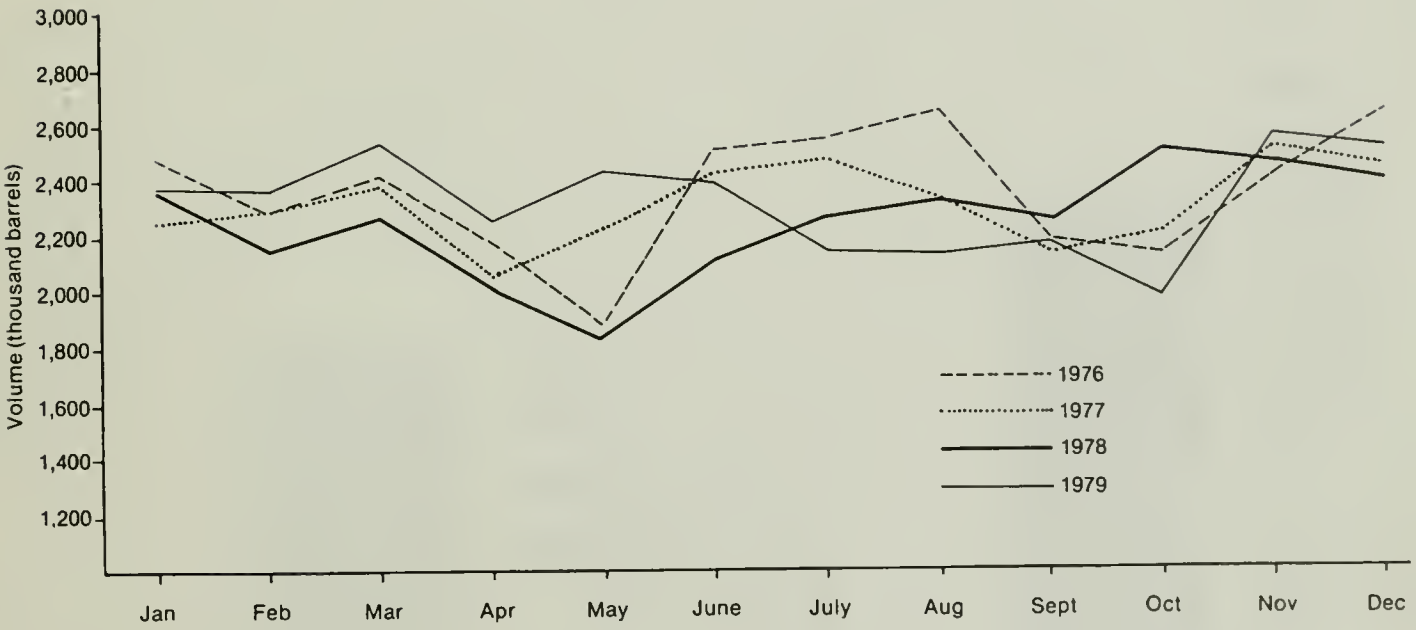
This information should be used with caution, however, since wholesale distributor marketing areas do not necessarily conform to county boundaries. For example, gasoline sales in Prairie county dropped by 42 percent in 1979, due to closure of one company's retail outlets in Terry, but the same company more than made up for this apparent shortfall by nearly tripling gasoline sales in Miles City, in another county but only 39 miles away.

Figure 4 Annual production of motor gasoline, 1972-79



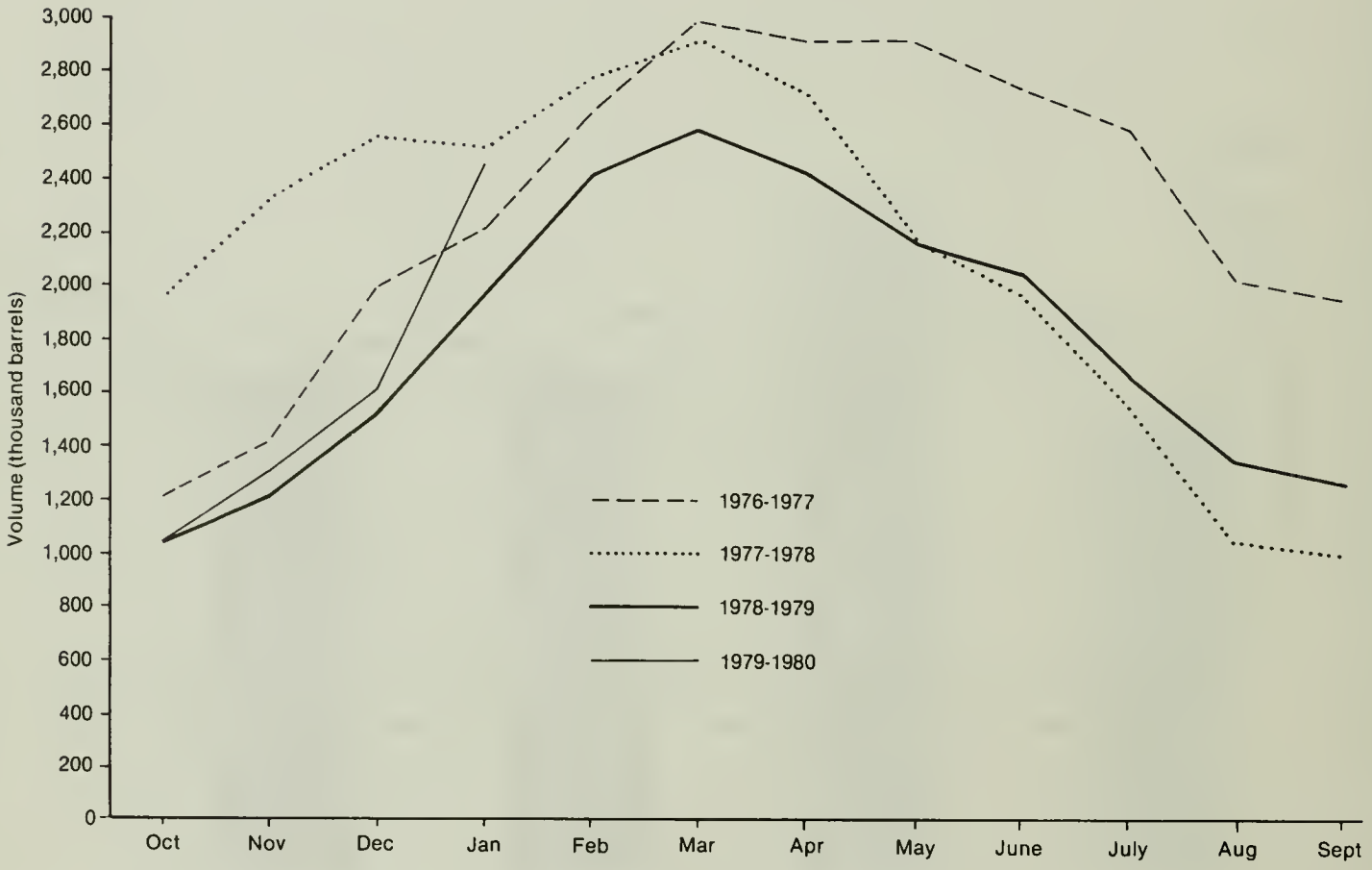
SOURCE: EIA 87.

Figure 5 Monthly production of motor gasoline, 1976-79



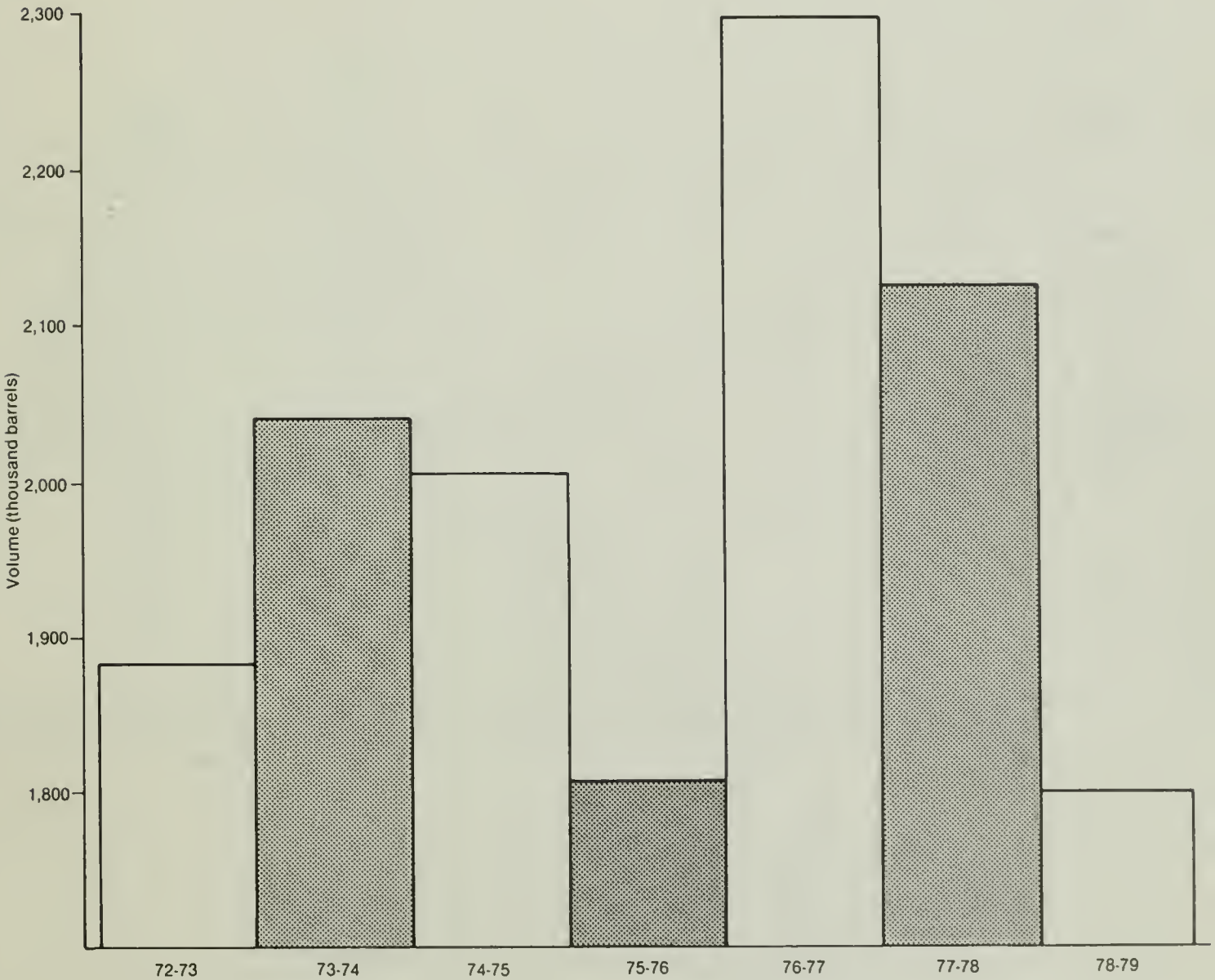
SOURCE: EIA 87.

Figure 6 Stocks of motor gasoline in primary and secondary storage, 1976-79



SOURCE: EIA 87 and EIA 88.

Figure 7 Stocks of motor gasoline in primary and secondary storage, annual average, 1972-79



SOURCE: EIA 87 and EIA 88.

Figure 8 Production, stocks, and prime-supplier deliveries of motor gasoline, 1976-79

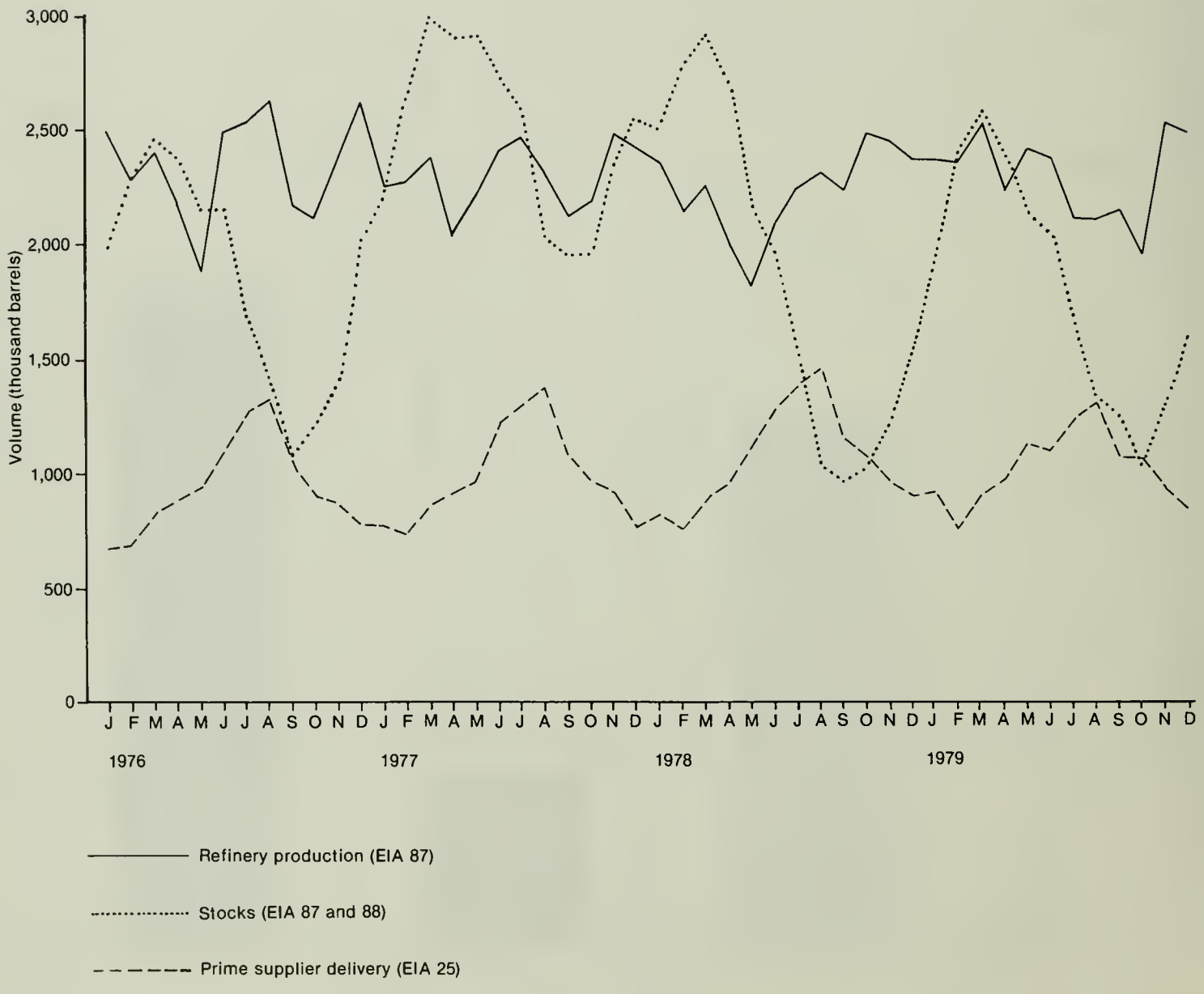
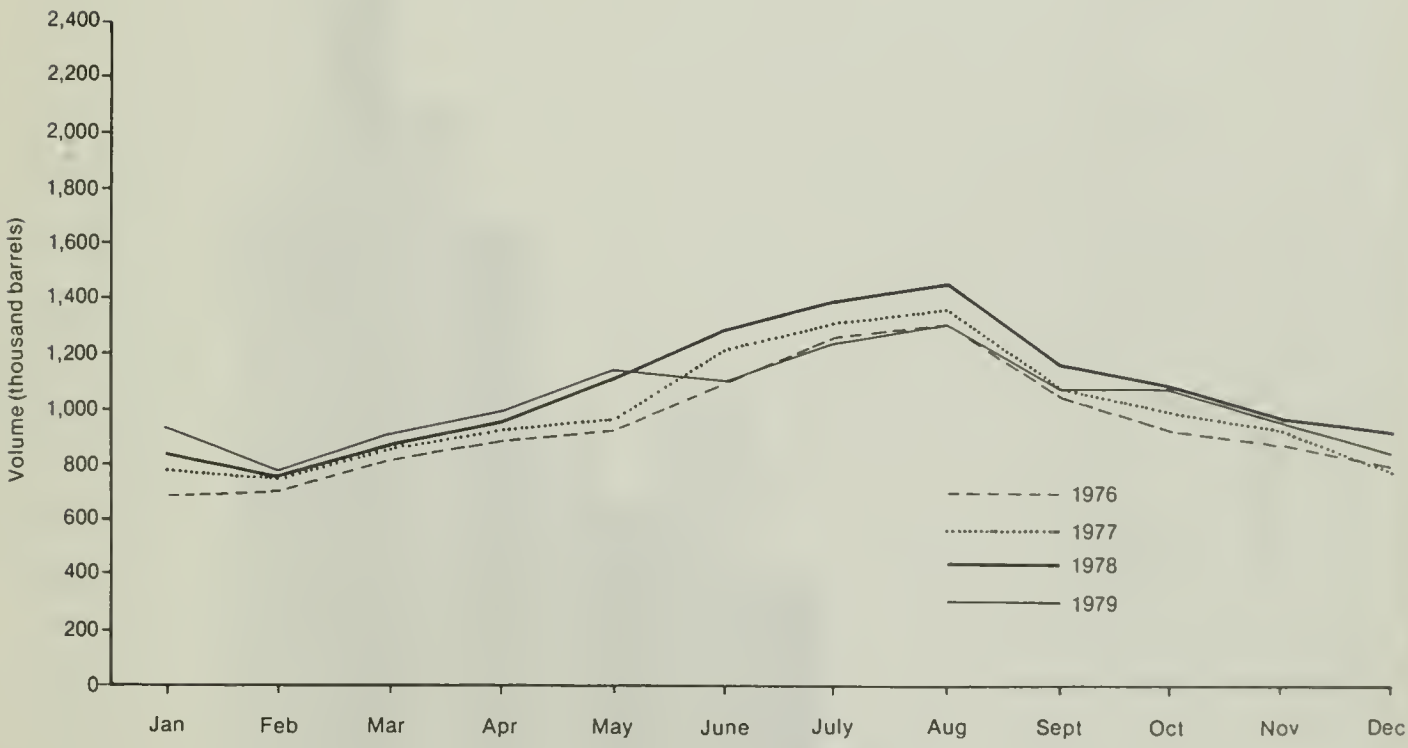
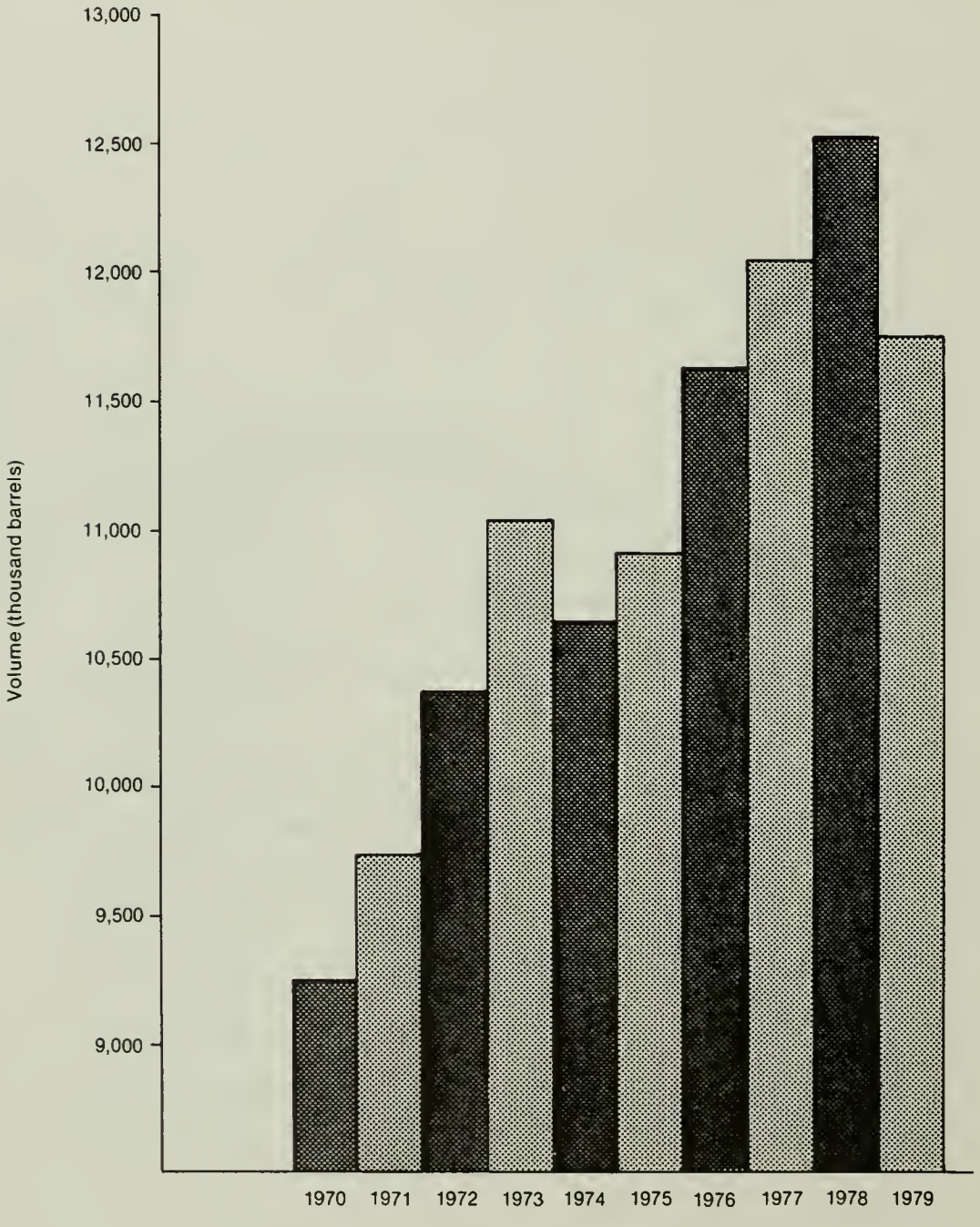

3,000
2,500
2,000
1,500
1,000
500
0
Volume (thousand barrels)
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1976
1977
1978
1979
Refinery production (EIA 87)
Stocks (EIA 87 and 88)
Prime supplier delivery (EIA 25)

Figure 9 Monthly deliveries of motor gasoline by prime-suppliers, 1976-79



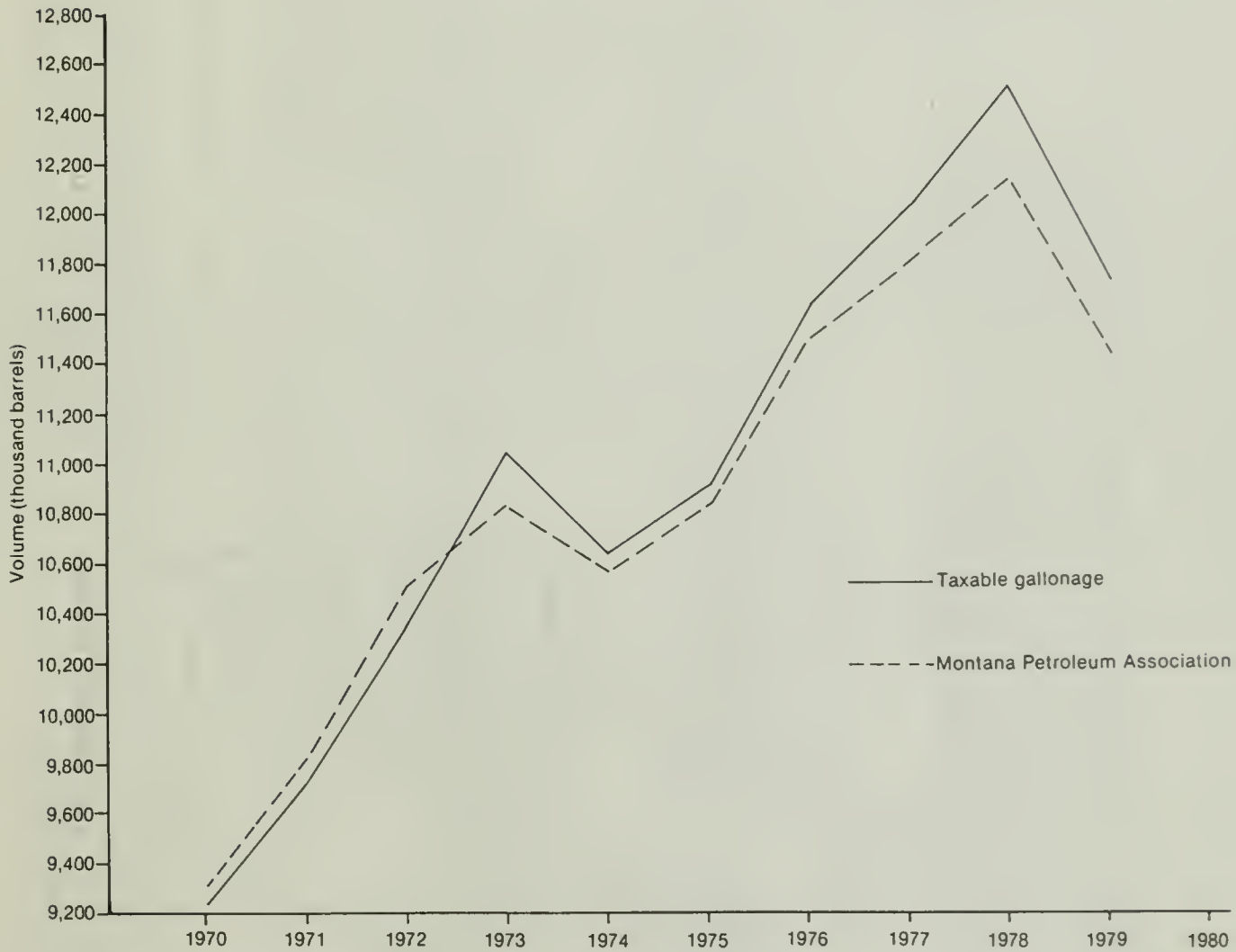
SOURCE: EIA 25.

Figure 10 Annual consumption of motor gasoline, 1970-79



SOURCE: Montana Department of Revenue.

Figure 11 Comparison of Montana Department of Revenue data and Montana Petroleum Association data on annual motor gasoline consumption, 1970-79



SOURCE: Montana Motor Fuels Tax Division and Montana Petroleum Association Gasoline Gallonage Report

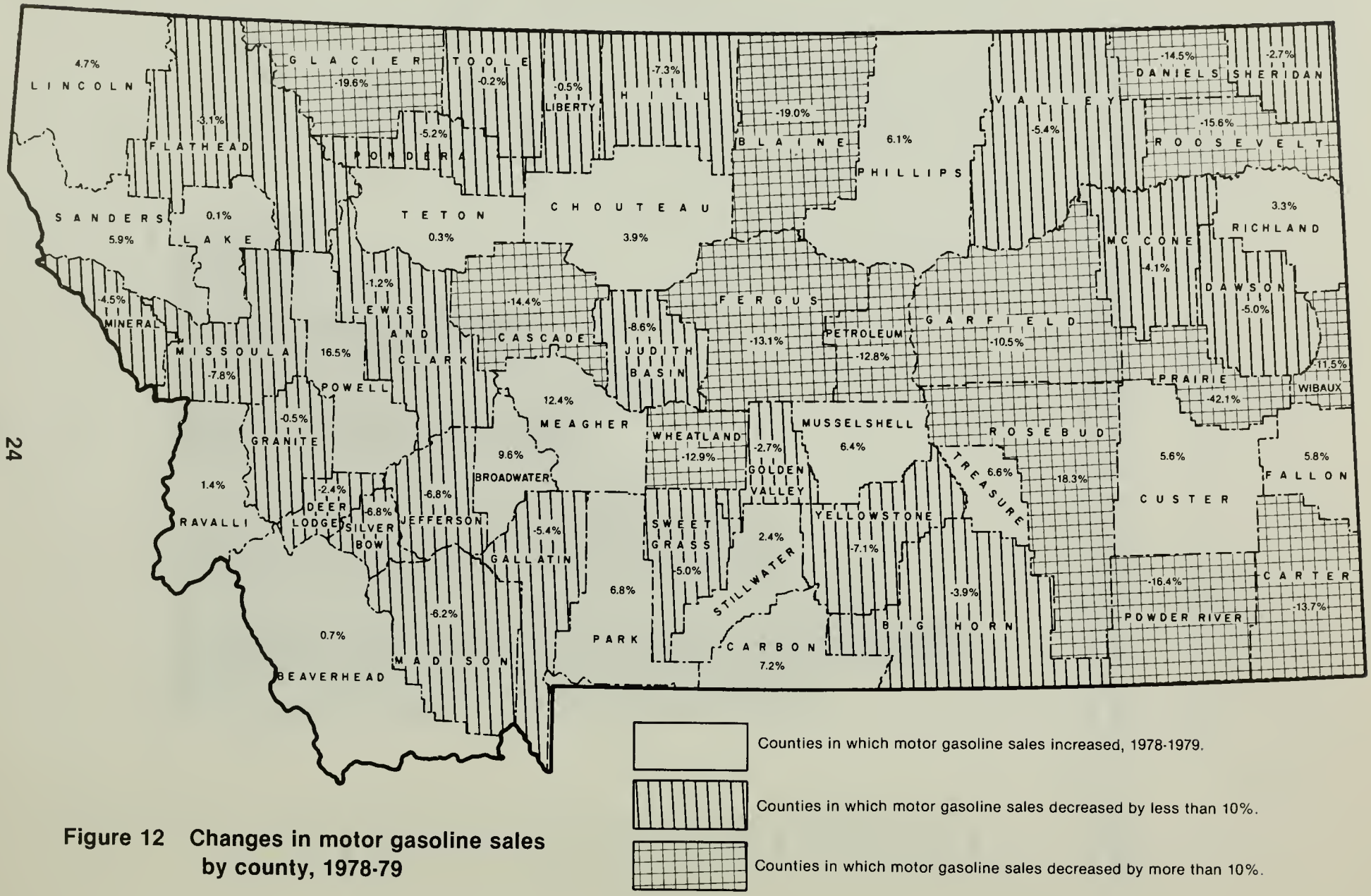


Figure 12 Changes in motor gasoline sales by county, 1978-79

TABLE 5
MOTOR GASOLINE SALES, 1978-1979, BY COUNTY

	GALLONS		
County	1978	1979	% Change
Beaverhead	7,997,155	8,050,555	0.67%
Big Horn	8,772,178	8,433,122	- 3.87%
Blaine	4,054,511	3,284,125	-19.0%
Broadwater	2,121,971	2,325,123	9.57%
Carbon	4,125,264	4,423,717	7.23%
Carter	1,131,998	976,761	-13.71%
Cascade	47,785,485	40,886,486	-14.44%
Choteau	3,574,819	3,715,602	3.94%
Custer	12,650,479	13,354,737	5.57%
Daniels	1,867,408	1,596,494	-14.51%
Dawson	12,751,363	12,112,799	- 5.01%
Deer Lodge	3,145,162	3,069,221	- 2.41%
Fallon	3,390,581	3,585,715	5.76%
Fergus	9,754,797	8,480,819	-13.06%
Flathead	27,534,717	26,695,219	- 3.05%
Gallatin	32,777,590	31,018,844	- 5.37%
Garfield	1,549,681	1,386,639	-10.52%
Glacier	9,754,467	7,844,622	-19.58%
Golden Valley	677,054	658,600	- 2.72%
Granite	2,201,383	2,191,260	- 0.46%
Hill	10,941,200	10,144,764	- 7.28%
Jefferson	2,551,125	2,376,804	- 6.83%
Judith Basin	2,521,896	2,305,592	- 8.58%
Lake	9,142,413	9,154,307	0.13%
Lewis & Clark	32,317,209	31,920,205	- 1.23%
Liberty	1,518,247	1,511,330	- 0.46%
Lincoln	7,132,639	6,814,022	4.68%
McCone	2,111,185	2,025,500	- 4.06%
Madison	3,605,153	3,380,941	- 6.22%
Meagher	1,748,693	1,964,677	12.35%
Mineral	3,660,485	3,495,002	- 4.52%
Missoula	57,278,583	52,915,784	- 7.62%
Musselshell	3,344,294	3,556,535	6.35%
Park	8,538,305	9,114,952	6.75%
Petroleum	643,003	560,531	-12.83%
Phillips	5,290,548	5,614,921	6.13%
Pondera	4,528,144	4,294,755	- 5.15%
Powder River	2,061,265	1,723,554	-16.38%
Powell	3,305,423	3,849,896	16.47%
Prairie	1,429,272	827,625	-42.09%
Ravalli	8,757,175	8,877,434	1.37%
Richland	8,327,017	8,604,959	3.34%
Roosevelt	8,026,860	6,776,045	-15.58%
Rosebud	3,801,300	3,106,351	-18.28%
Sanders	4,119,370	4,362,026	5.89%
Sheridan	3,211,072	3,124,296	- 2.70%
Silver Bow	18,194,366	16,993,381	- 6.60%
Stillwater	3,583,569	3,670,410	2.42%
Sweet Grass	3,314,530	3,147,924	- 5.03%
Teton	4,591,690	4,605,912	0.31%
Toole	5,085,510	5,077,554	- 0.16%
Treasure	936,434	998,441	6.62%
Valley	7,664,411	7,253,221	- 5.36%
Wheatland	2,762,863	2,407,473	-12.86%
Wibaux	235,535	208,450	-11.50%
Yellowstone	66,021,178	61,337,317	- 7.09%

SOURCE: Montana Petroleum Association

Distillate Fuels

In recent years refinery output of distillate fuel oil (including kerosene) in Montana has averaged between 12 and 14 million barrels annually. Total annual production, graphed in figure 13, apparently peaked in 1973, dropped sharply in 1974 and, after a slight increase in 1975, declined slowly each year from 1975 through 1978. The steady decrease in production was reversed in 1979 when distillate output increased by more than 1 million barrels, or 8.6 percent over the 1978 level.

Although there are monthly fluctuations in the quantity of distillate produced, as shown in figure 14, there are no consistent seasonal trends, except that production seems to be lowest in April.

The average volume of distillate fuel oil held in storage in Montana refineries and bulk terminals has declined steadily in recent years, compared with the high inventory levels maintained in 1974. This trend is depicted in figure 15. Stocks averaged about 12 percent less in 1979 than in 1978, and 1978 inventories were, on the average, more than 15 percent less than 1977.

Monthly trends suggest that distillate stocks fluctuated seasonally on a June to May cycle prior to 1978. Figure 16 indicates that 1978 stocks were drawn down to a minimum level in June and have been maintained at a relatively low level since that time. On October 31, 1978, distillates in storage in Montana reached the lowest volume in four years, even though President Carter had set this date as the one by which the oil companies were to have built distillate stocks to maximum levels for the winter heating season.

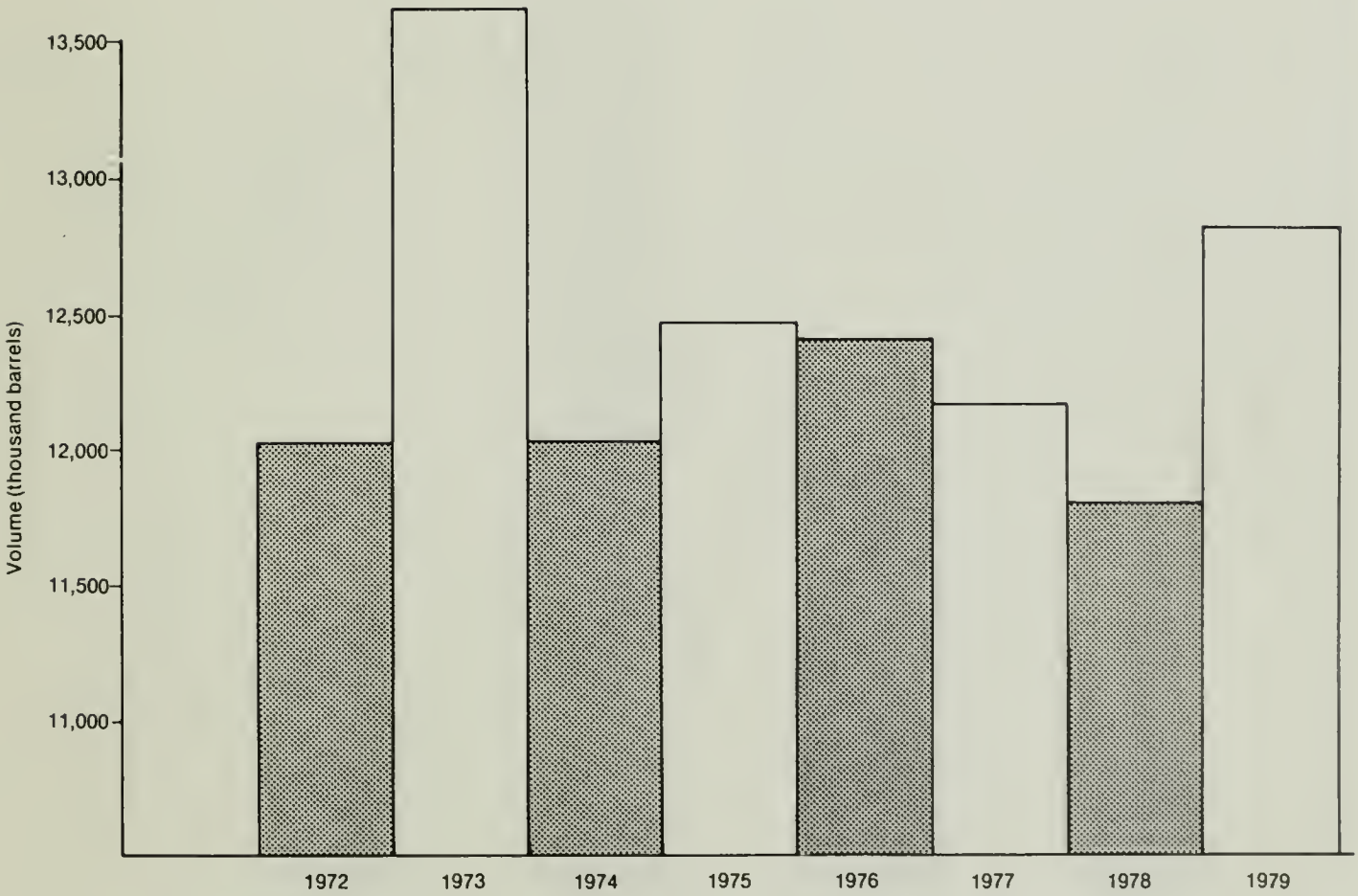
Monthly data on refinery production and stocks of distillate fuel relative to prime-supplier delivery of these products is depicted in figure 17. This comparison further demonstrates that companies have maintained lower inventories since June, 1978.

According to the prime-supplier reported delivery data for the years 1977 to 1979, graphed in figure 18, distillate fuel supplies in Montana were up 18 percent over 1978 deliveries, during the first three months. Supplies fell in April but climbed again in May, for an average 10.2 percent increase in reported distillate deliveries in the first five months of 1979.

Throughout the rest of 1979, however, oil companies supplied less distillate in every month than in the previous year. In the summer months, from June through September, deliveries averaged about 3.5 percent less than in 1978. Supplies fell even further in the fall, down almost 10 percent below 1978.

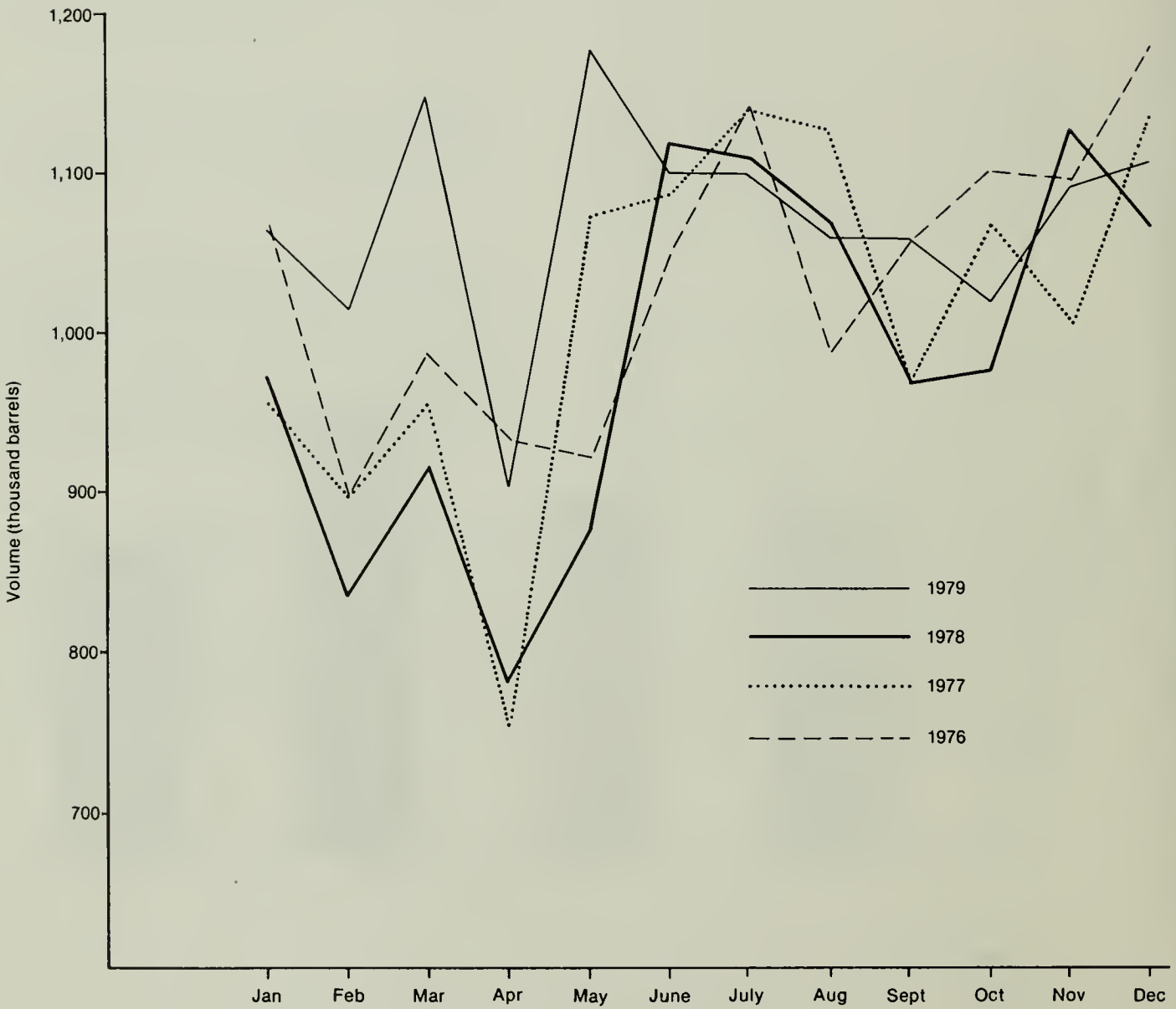
The prime supplier delivery data reviewed here may be incomplete; and therefore this assessment of Montana fuel supply may not be accurate. According to surveys carried out by the DOE Office of Energy Data and Interpretation, company sales of distillate fuel oil in Montana were 15 to 25 percent greater than prime-supplier reported deliveries to the state in 1976-1978. Annual totals from these two sources of data are illustrated in figure 19.

Figure 13 Annual production of distillate fuels, 1972-79



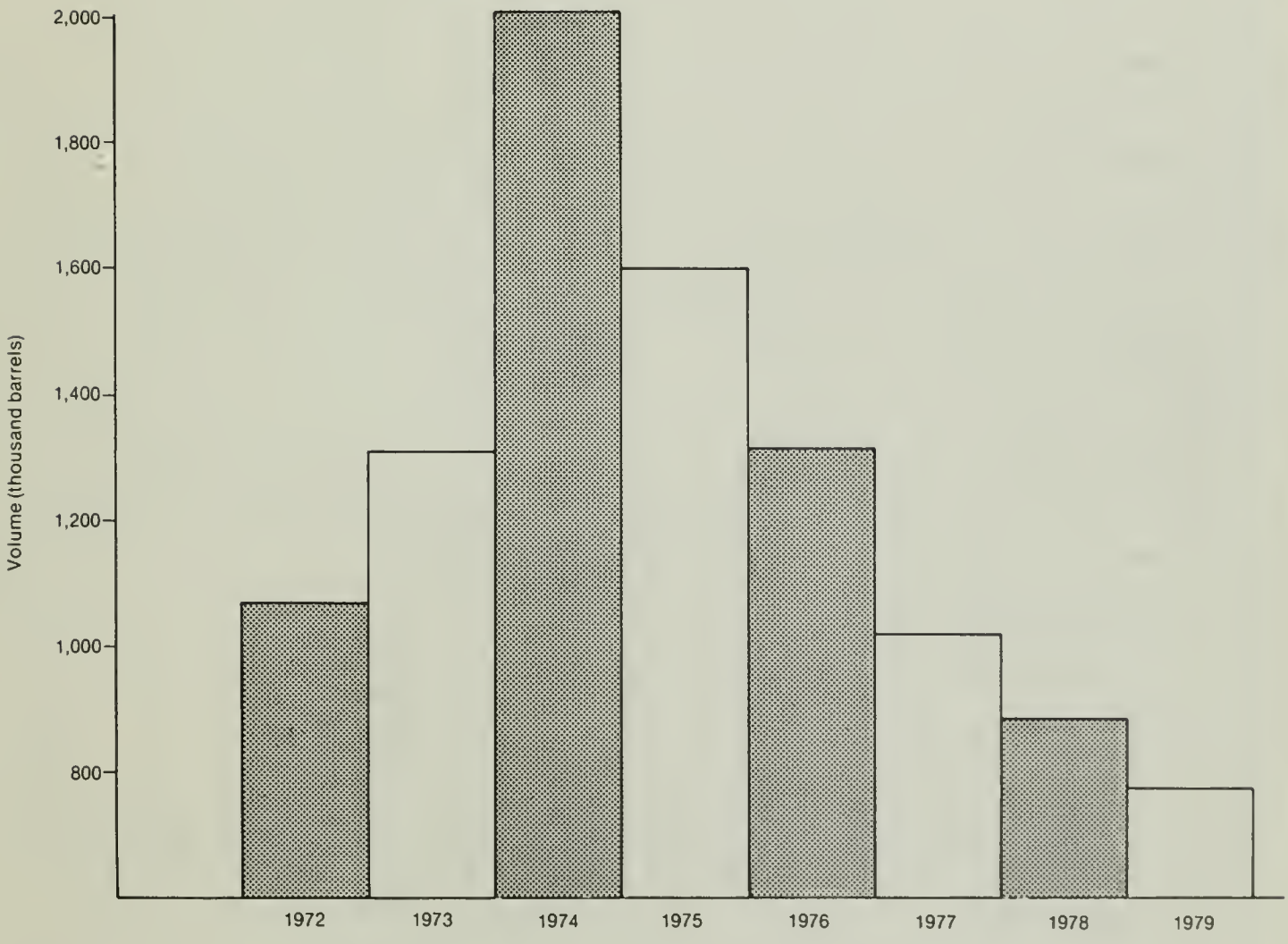
SOURCE: EIA 87.

Figure 14 Monthly production of distillate fuels, 1976-79



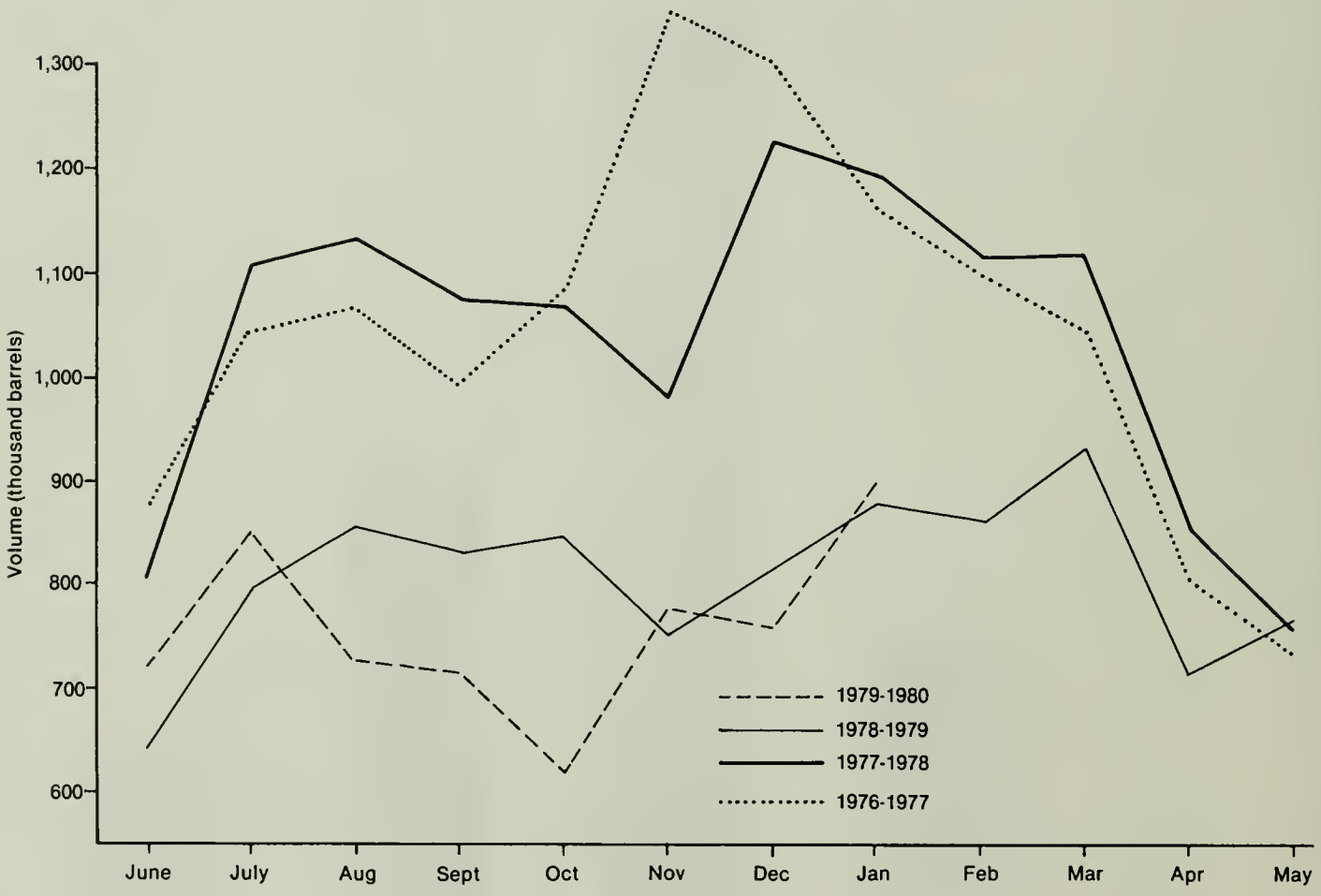
SOURCE: EIA 87.

Figure 15 Stocks of distillate fuels in primary and secondary storage, annual average, 1972-79



SOURCE: EIA 87 and 88.

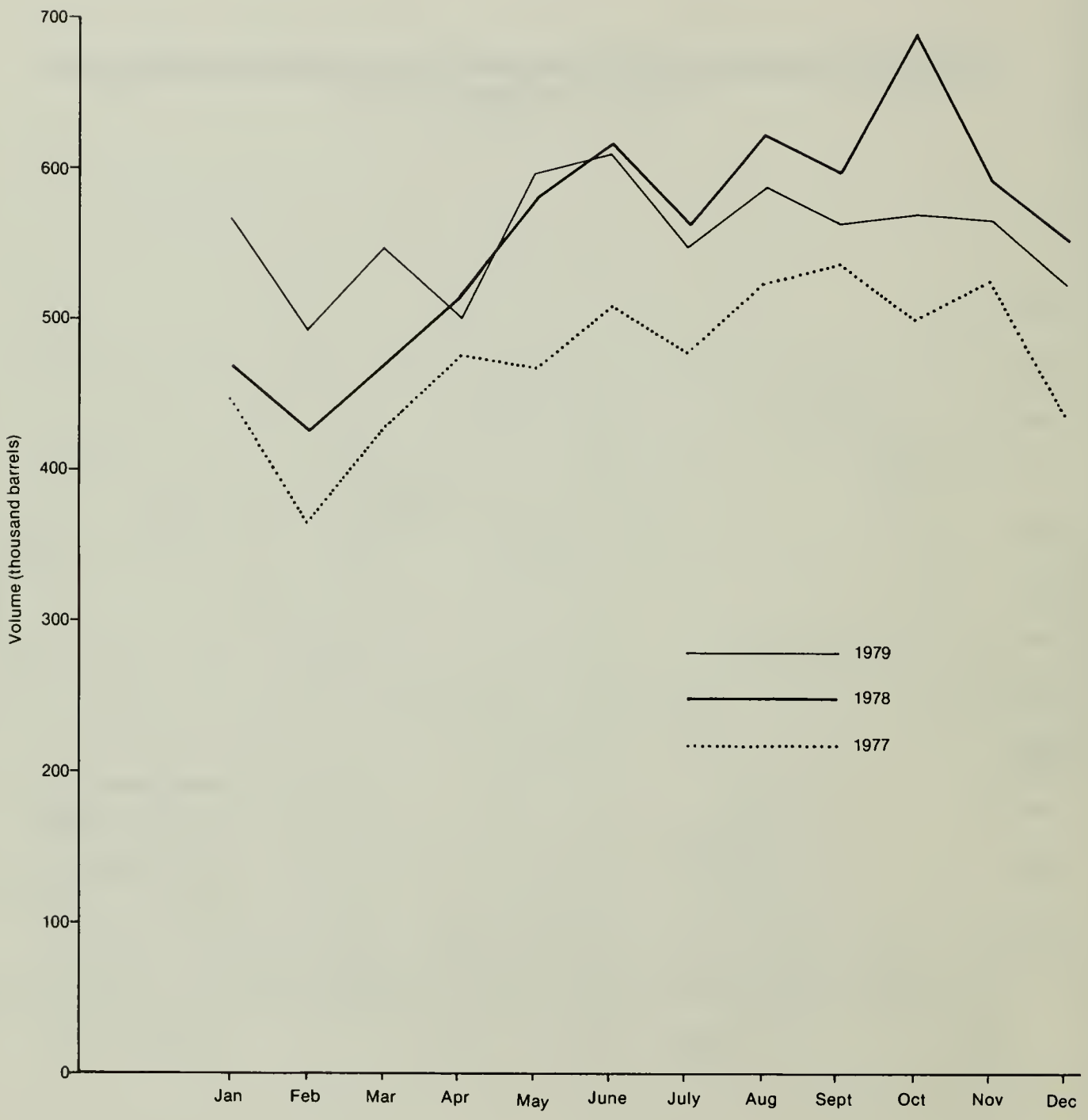
Figure 16 Stocks of distillate fuels in primary and secondary storage, June through May, 1976-79



SOURCE: EIA 87 and 88.

Figure 17 Production, stocks, and prime-supplier deliveries of distillate fuels, 1976-79

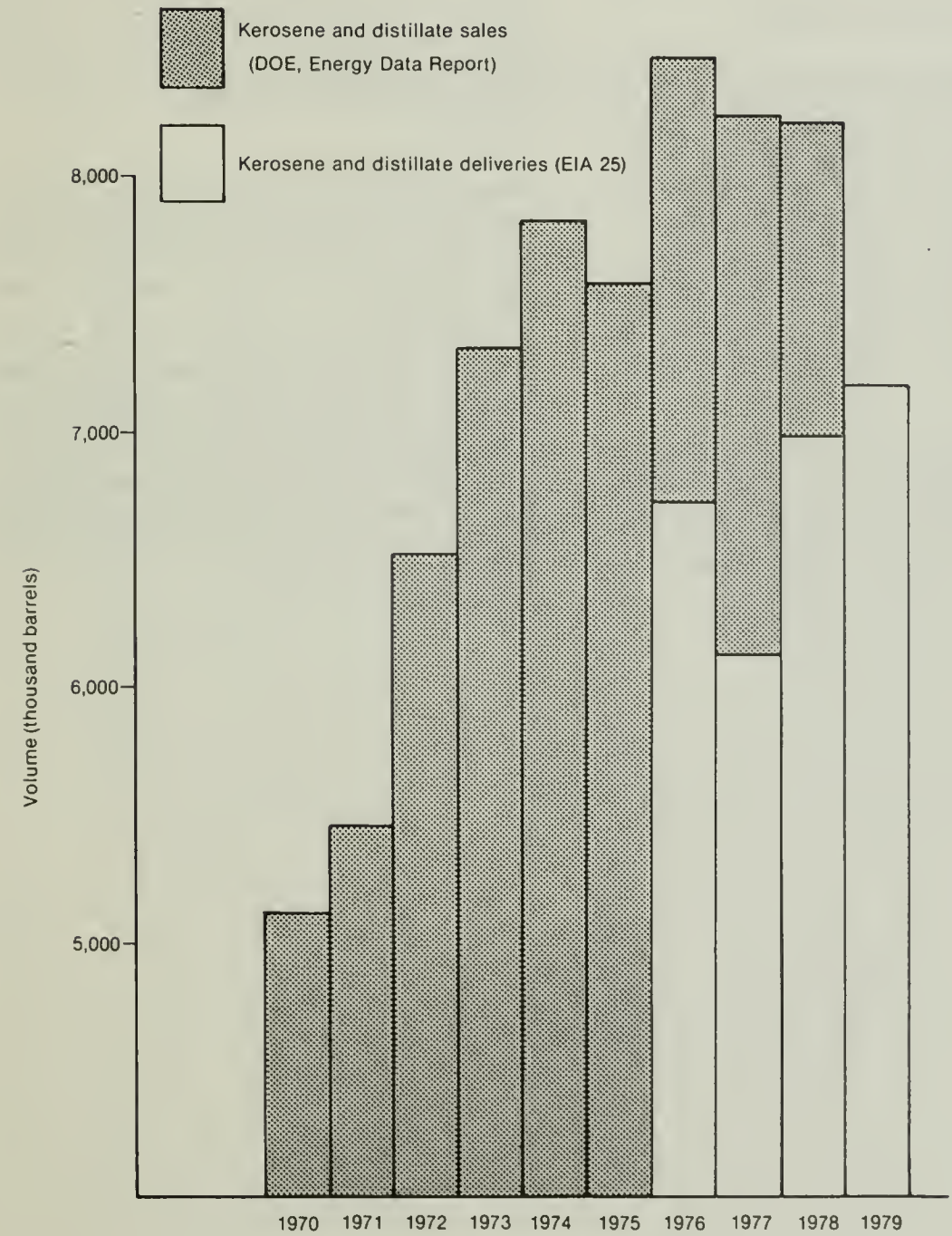
Figure 18 Monthly deliveries of distillate fuels* by prime-suppliers, 1977-79



*excluding "other mid-distillates"

SOURCE: EIA 25.

Figure 19 Annual sales and prime-supplier deliveries of distillate fuels, 1972-79



Aviation Gasoline

Montana refinery production of aviation gasoline fluctuates considerably each month as shown in figure 20. Although production fell to fairly low levels in September and October 1979, refinery officials have explained that this resulted from downtime for planned maintenance. Refinery production for the year was up 19 percent over 1978 output.

Since Montana is a net importer of this specially processed high-octane fuel, refinery production data do not provide a complete picture of the volume physically available to the state. No information regarding the volume imported from refineries in Casper, Wyoming and Salt Lake City, Utah is available, though the volume of net imports, determined by subtracting prime-supplier delivery from refinery production, indicates a decrease in 1979 of 1.6 million gallons, or 73 percent, from 1978 imports.

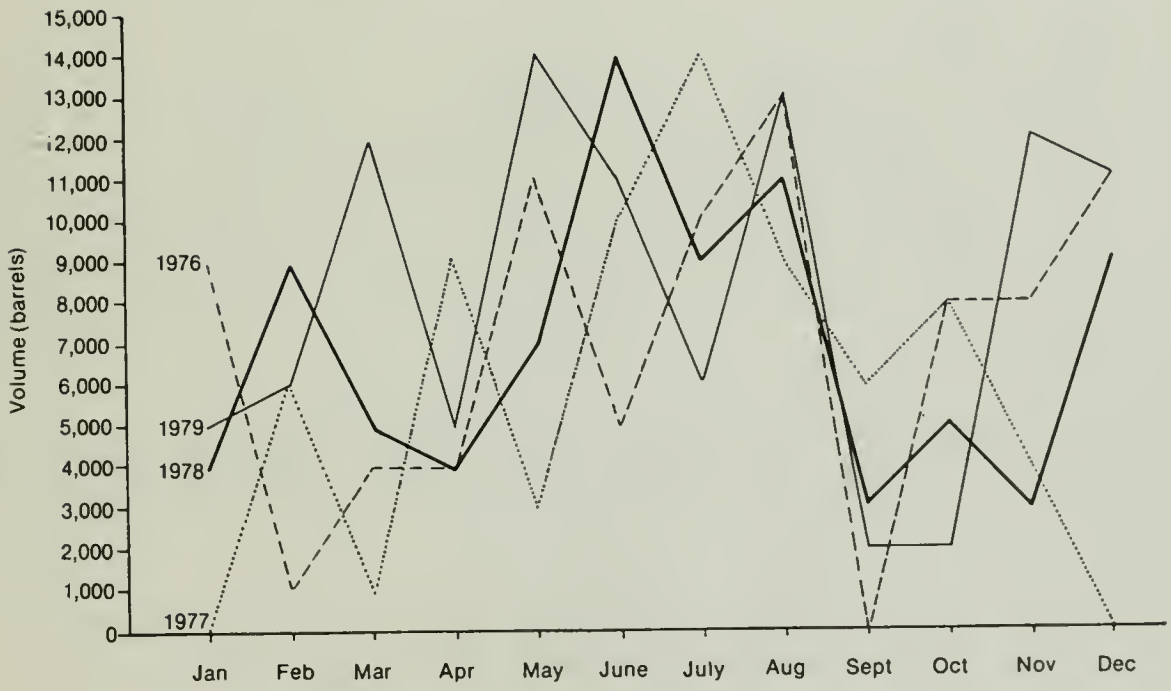
Stocks of aviation gasoline held in inventory at Montana refineries fell below previous year's levels in July, 1979, and remained low through October. These data, illustrated in figure 21, are the only inventory data for aviation gasoline. Apparently this fuel is not retained in inventory at the bulk terminals in Montana.

Aviation gasoline supplied to Montana consumers decreased by about 17 percent from 1978 to 1979, according to prime-supplier reports. The seasonal variation in supply, depicted in figure 22, suggests that consumption of aviation gasoline is lowest during winter months, gradually increases through the spring, and reaches its maximum during the summer.

This seasonal trend is even more apparent in Montana Motor Fuels Tax Division data for aviation gasoline. Monthly consumption data from this source is graphed in figure 23, along with the prime-supplier delivery data for 1976 through 1979.

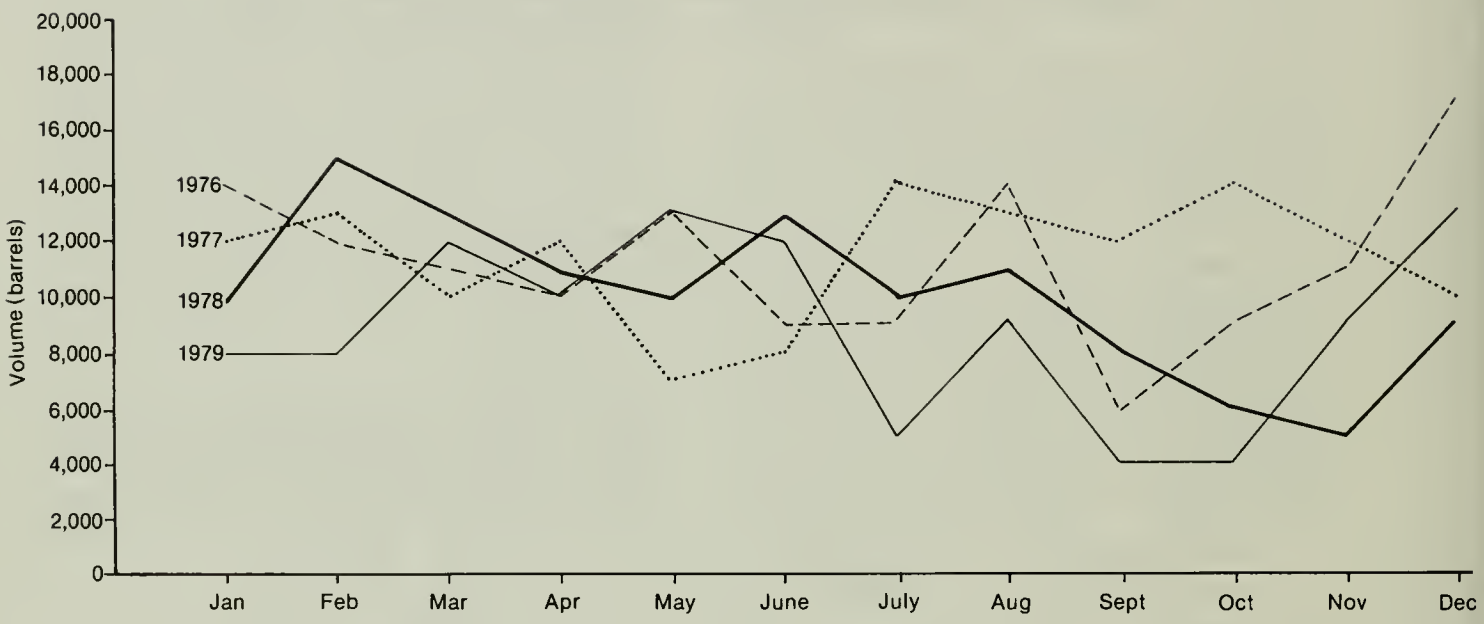
If the tax data are correct, then the prime-supplier reports of aviation gasoline supplies delivered to Montana are not accurate. The annual volume of prime-supplier reported delivery is compared with the volume taxed in figure 24. The tax data indicate that instead of decreasing by 17 percent, as the prime-suppliers reported, Montana consumption actually grew by 3.6 percent from 1978 to 1979.

Figure 20 Monthly production of aviation gasoline, 1976-79



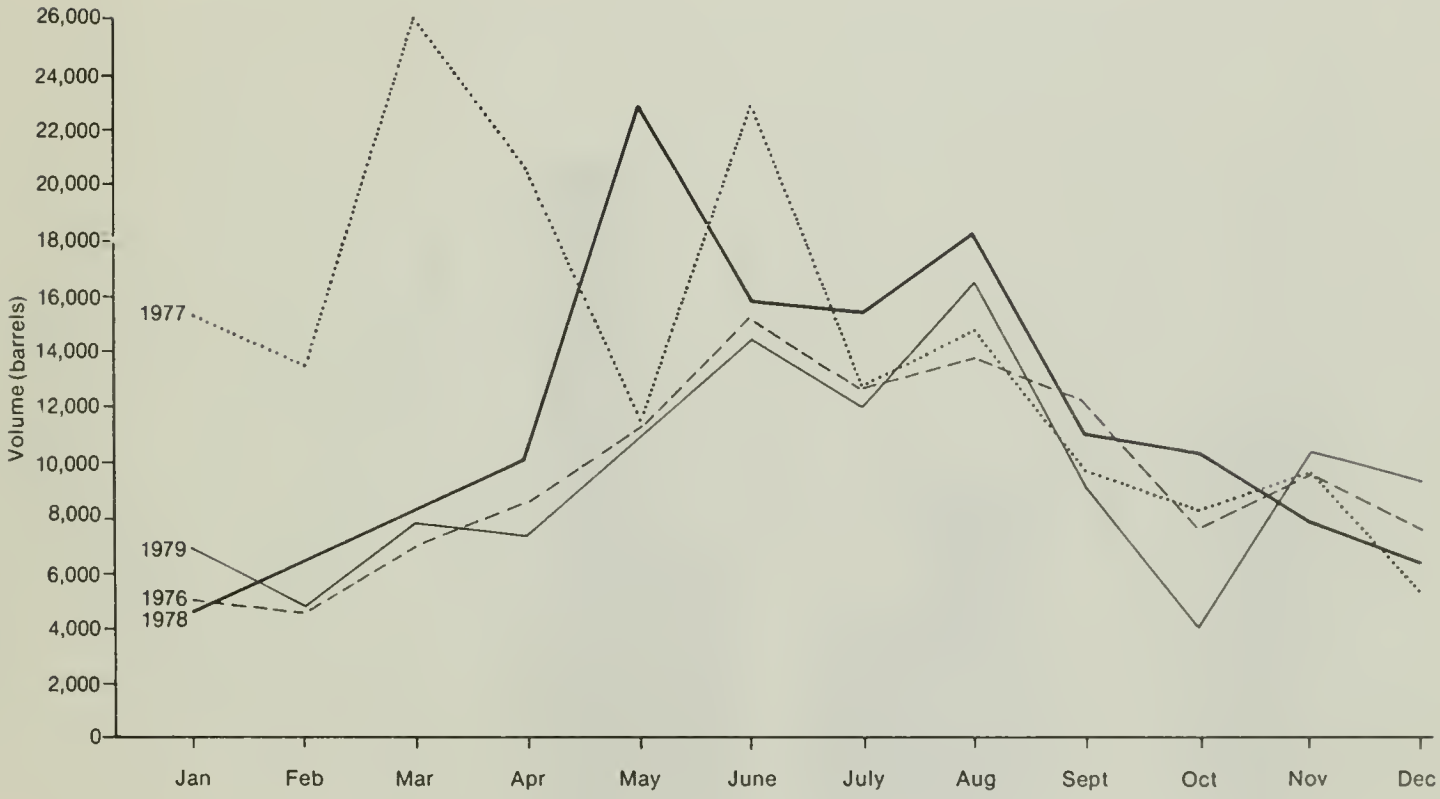
SOURCE: EIA 87.

Figure 21 Stocks of aviation gasoline, 1976-79



SOURCE: EIA 87.

Figure 22 Monthly deliveries of aviation gasoline, 1976-79



SOURCE: EIA 25.

Figure 23 Comparison between prime-supplier reports and Montana Department of Revenue data on monthly aviation gasoline consumption, 1976-79

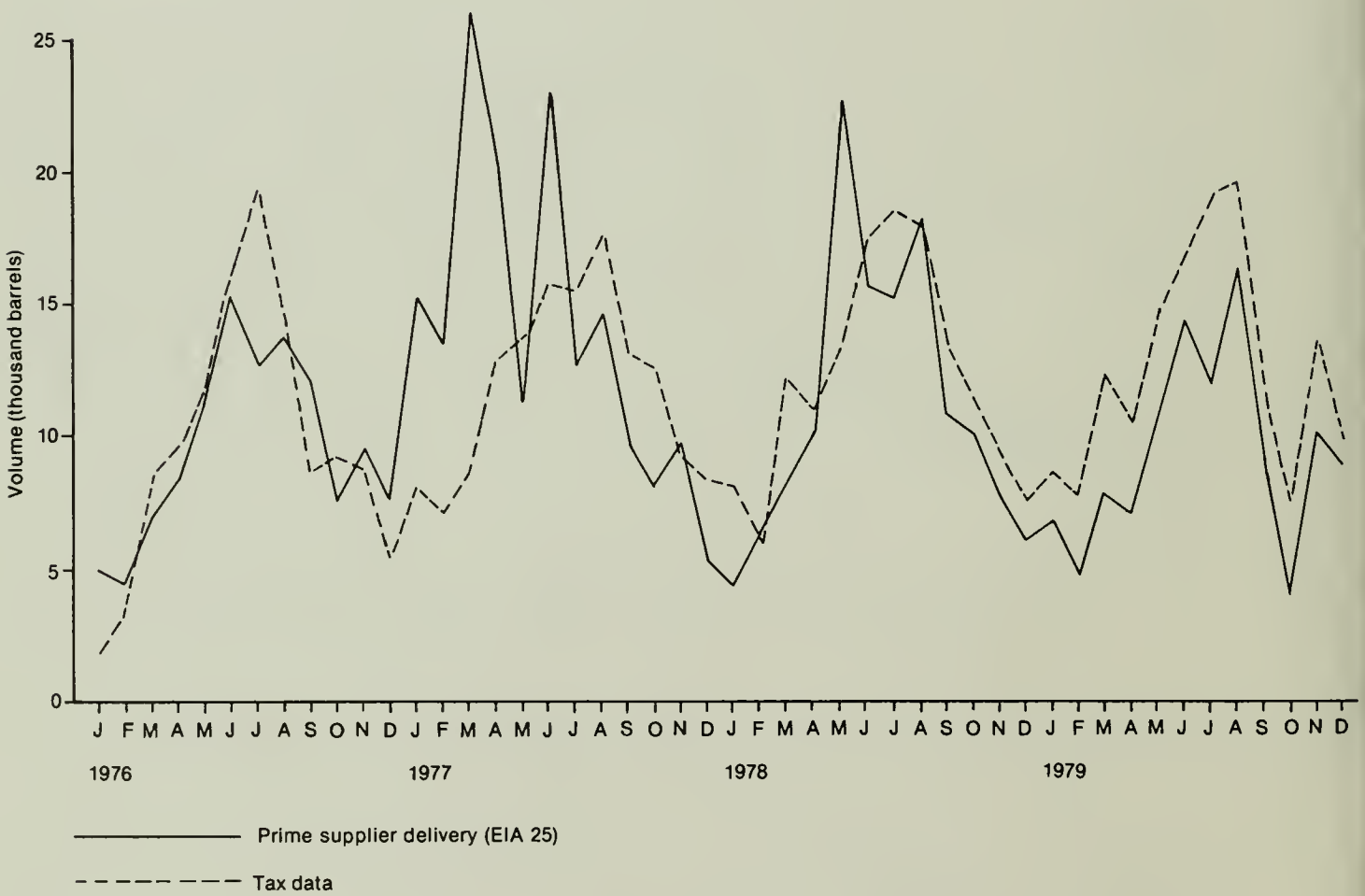
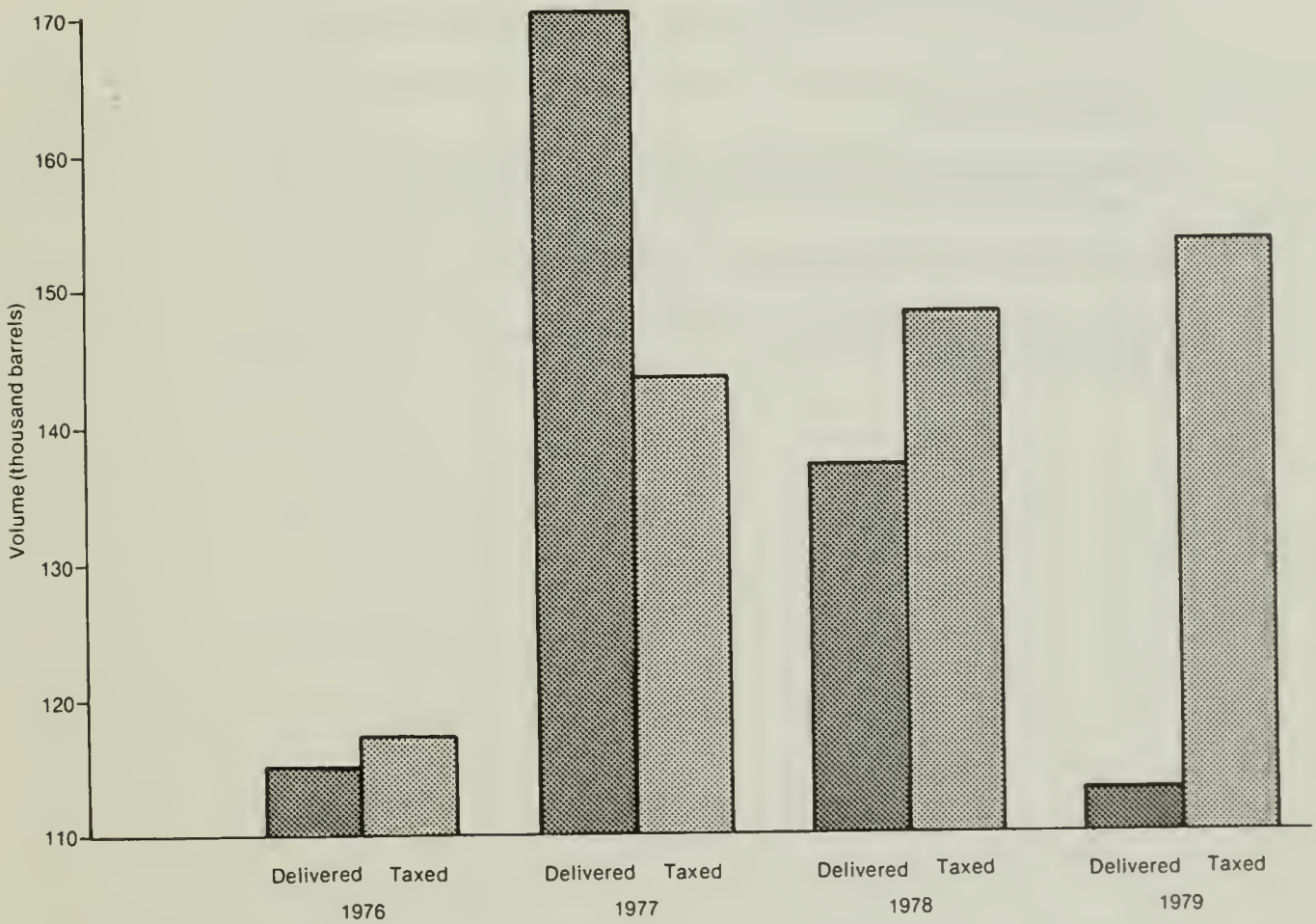

Volume (thousand barrels)
25
20
15
10
5
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1976
1977
1978
1979
Prime supplier delivery (EIA 25)
Tax data

Figure 24 Comparison between prime-supplier reports and Montana Department of Revenue data on annual aviation gasoline consumption, 1976-79



SOURCE: EIA 25 and Montana Department of Revenue.

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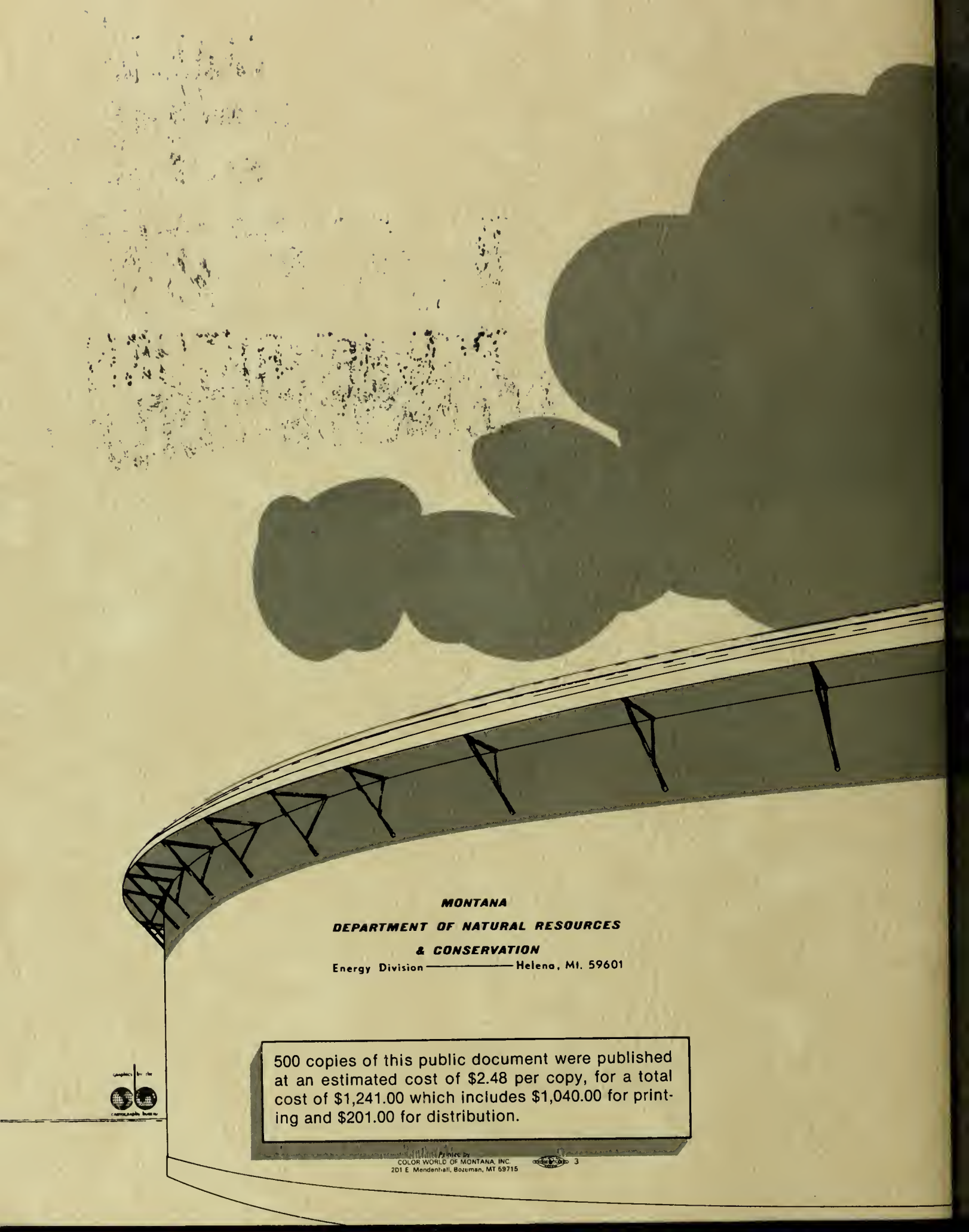

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